

# 1. ORIGIN OF THE UNIVERSE

The universe with its vastness and variety, myriads of dazzling galaxies and unfathomable skies has bewildered man from times immemorial. He wondered about its origins ever since intelligence dawned on him. The Taittiriyaopanishad says, "In the beginning all this universe was nonexistent and unmanifest from which this manifest existence was born." It adds, '*Om iti Brahma prasaoti*' (With Om Brahma starts). Explaining, the Upanishad adds, "*Sokaamayata, bahusyaam, prajaayeya, spandena*" (He/It thought: Proliferate, for creation, by vibration).

The current scientific thinking, no doubt, resonates some of these Upanishad concepts. But scientific approach is basically different. Nothing is handed down in science as a final conclusion. Several observations are made, theories are developed, consequences are predicted, outcomes are verified, concepts killed and or remade. There could be disappointments, frustratingly long waits in crosschecking, or exhilarating excitement of a proven idea. Careers could be made or ruined. But there are all-round benefits. In the process of developing the scientific theories, unlike in religion, several technological fallouts accrue with useful gadgets and products that generally help the common man. After a gigantic effort of millions of scientists, millions of published research papers, thousands of PhDs awarded, and several Nobel prizes won, we now have some understanding on how the universe had originated.

The distant stars and galaxies are receding from us at a fast pace. Indeed space itself is growing like an inflated balloon. We are in an expanding universe. In retrospect, going back in time, the universe must have been hotter, smaller and denser. An explosion took place about 13.7 billion years ago setting forth the universe on a path of expansion. Prof. Fred Hoyle derisively called this explosion "Big Bang", since this idea contradicted his views. But the name stuck. The "Big Bang" theory stayed. Hoyle's ideas were dethroned. To date, it is the best bet that fits the observed data, offers a blow-by-blow account of the evolution of the universe (see the Table) and makes reasonably verifiable predictions.

The Big Bang was not like a Diwali cracker exploding into empty space from a single spot. Each point everywhere in the whole universe was exploding creating space and time with it. It is incorrect to say that the universe in the beginning was tiny. The infinite universe, when compacted, still remains infinite. Expanding universe does not also mean that your house or city is expanding. One may visualize the galaxies (including our world) in expanding space as raisins on rising dough – the raisins stay the same; but the dough between any two raisins increase. (Some of these concepts are hard even for physicists to visualize. So do not despair if it is not clear at the first stroke). A point of interest to note here: Brahma is derived from Sanskrit root '*Brih*' to spread out, to expand. The Vedic concept "*brahmamayam jagat*" means universe is filled with expansion. Is all round expansion implied by the word Brahma?

Dr. G. Musser of *Scientific American* writes, "The big bang is best thought of not as a singular event but as an ongoing process, a gradual molding of order out of chaos." Initially the universe was a hot, dense ball of radiation. As the universe had expanded and cooled, quarks and antiquarks (smaller than subatomic particles) condensed. The familiar particles of matter, such as electrons and protons formed after a series of interactions between matter and radiation. "Over the ensuing eons, matter organized itself into bodies of increasingly large size: Stars, Subgalactic Scraps to Great Walls of Galaxies by gravitational agglomeration. Our solar system formed 9.2 billion years after the Big Bang. The sun has another five billion years of life to go. New galaxies and solar systems are still forming. The rate at which new galaxies are forming looks, however, to have slowed down as per the latest evidence.

The most important evidence for the Big Bang explosion comes from "Cosmic Microwave Background (CMB)" radiation. About 380,000 years after the Big Bang, the universe was a thousandth of its present size and the temperature was 3000°K (=2727°C). That was the moment of "Let there be light"! Light (photons) could for the first time scatter freely in space unhindered by interactions with matter. We can today detect that ancient glow as CMB.

To understand what CMB is, let us imagine a piece of iron heated by an ironsmith in his oven. The iron becomes hot and looks white. As it cools, it turns red and on further cooling becomes its dark self. This does not mean it stopped losing heat. It continues to emit heat called

infrared radiation. You can feel the warmth, but cannot see the heat. On further cooling, an afterglow continues to be emitted like CMB but can be measured only by special instruments. To give a perspective in human terms we may say that if the Universe were a middle-aged person today, CMB corresponds to a snapshot of an embryo at 10 hours age.

Based on the Big Bang theory, the temperature of CMB at the present time can be calculated to be in the microwave range of  $2.73^{\circ}\text{K}$ . Latest satellite measurements in all directions of the universe precisely match the calculated temperature, conclusively proving the Big Bang Theory. Some popular science writers exalt CMB as “OM” (*naada* = sound) permeating the entire universe. You may be surprised that you are yourself watching this heavenly relic, CMB, all the time – in that annoying ‘snow’ on your TV channel!

The Big Bang theory, however, cannot explain the clumpy structure of the universe (large galactic masses separated by huge void spaces) or its shape (flat like a *dosa* (pancake) and not spherical like *laddu* (ball)). Cosmologists proposed a sudden inflationary burst preceding the Big Bang to explain these features. Recent astrophysical evidence is mounting in support of this concept. See Figure 1. Big Bang Expansion.

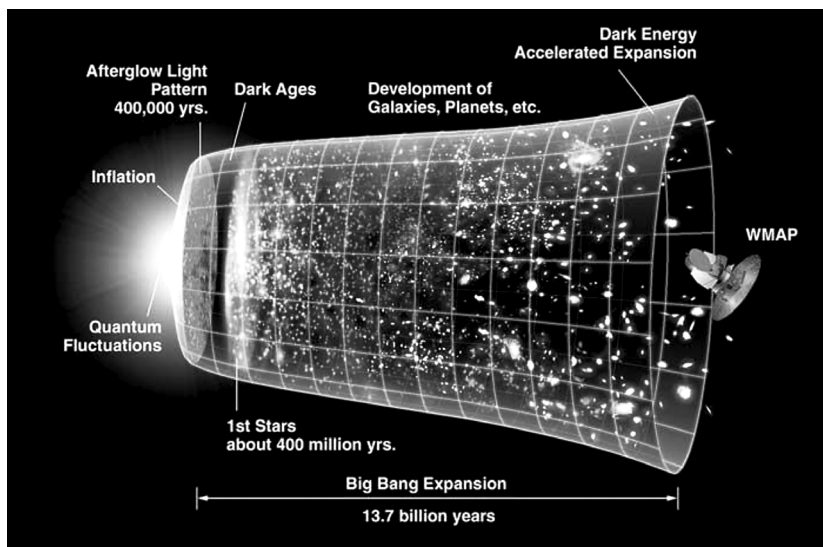


Fig. 1. Inflation and Big Bang Expansion of the Universe  
(Source: WMAP team and NASA)

But what was it that exploded in a bang? We don't have a physics that can provide an answer. Einstein's theory breaks down because it cannot look past the Big Bang. Quantum theory fails because what was there was too massive. We need New physics. It is a common experience of all of us that we scramble to an elevated ground in order to get a better look at something that we cannot see from where we stand. That is we move to a higher dimension for a better view. In physics too this strategy works. The laws of nature simplify when self-consistently expressed in higher dimensions. The disparate elements suddenly fall into cohesive oneness. For example, the magnetic and electric forces look different and act linearly (in one dimension). Their unity is apparent when an electromagnetic field in two dimensions is considered as was done by Faraday and Maxwell. Matter and energy stand apart in three dimensions. Einstein established their interchangeability in four dimensions. Kaluza unified Maxwell's and Einstein's equations considering five dimensions.

We need to likewise go for more dimensions in order to answer what was there before the Big Bang. The mathematics invented by Srinivasa Ramanujan help fix the required number of dimensions at 11 – ten of space and one of time! The highly mathematical M – theory provides a handle to deal with the physics of 11- dimensional space-time where the basic building block is a string. All fundamental particles that our matter is made up of (and hence all matter) are mere vibrations of these strings. (Recall Taittiriyaopanishad's cryptic statement, '*spandena*'!). The strings are a millionth of a billionth of a billionth of a billionth of a centimeter long. That is their minimum size. They cannot be reduced any further. If you apply any force to reduce them further, they rebound and become heavy. On the scale of strings, space-time suffers violent and rapid changes: as if forever being chopped up and reconnected. Thus the M-theory considers the Big Bang as not the 'origin of the universe but simply as an outcome of a pre-existing state'. In other words, matter goes through cycles of compression and expansion, i.e. assimilation and creation.

We don't know whether the strings really exist. The smallest particles so far produced in the laboratory are quarks and electrons, which though considered dimensionless, are billion billion times bigger than a string. Huge experimental setups are designed to verify string theory. Satellite borne astronomical observations are also planned. It will be quite some years to get the results. Some physicists proposed a

ouncing universe every trillion years postulating the existence of very 'spacetime particles' an echo of which we find in Yogavaasishta.

The origin of the universe has been a fundamental question in philosophy, religion and science. The ancients contemplated over it. Modern science teases out the processes.

There is no final answer yet. New theories at the cutting edge are emerging to tackle the question. With all this, we are talking about 4 percent of the Universe! We do not have a means to know about the rest 96 percent. Prof. Haldane once remarked, "The universe is not only queerer than we suppose, but queerer than we can suppose" "the most incomprehensible thing about the universe is", as Einstein said, "it is comprehensible." So our probe continues on.

## ORIGIN OF UNIVERSE - CHRONOLOGY OF EVENTS (From Various Sources)

[In the Table below Temperature is given in degrees Kelvin (273 deg K = Zero deg Centigrade).

The number  $10^{-43}$  means a very small fraction of a second. It is equal to one divided by ten 43 times.

In decimal notation it will be equal to

[illegible]

$10^{32}$  means a very large number equal to one multiplied by ten 32 times.

Other superscripts have a similar meaning.

Sec is seconds, Min is minutes, Yrs is years since the beginning.]

TIME	TEMPERATURE	STATE OF THE UNIVERSE
Earlier than 13.7 billion Years	?	Nothing is known about what was there or what it was like whatever that was there. We shall start here counting Time here as Zero ( $T_{\text{zero}}$ )
$T_{\text{zero}}$ to $10^{-43}$ Sec	Infinity to $10^{32} \text{ }^{\circ}\text{K}$	The present day physics is inadequate to tell us about the Properties of the universe. New theories are needed. Matter and Energy were indistinguishable; the four forces In Nature were unified into one. Possibly an 11-D Universe breaks down and a 4-D universe is generated. According to some scientists, there were branes (membranes) whose collision gave raise to our universe On one of the branes. Possibly tiny strings existed.
$10^{-35}$ Sec	$10^{28} \text{ }^{\circ}\text{K}$	Some theories propose a sudden expansion (inflationary Burst) to explain the clumpy nature of the universe (i.e. vast empty spaces and clusters of galaxies). This burst explains why our universe is more like a <i>dosa</i> (pan cake) and not a <i>Laddu</i> (ball) in shape. Recent Satellite data is supporting this theory.
$10^{-11}$ Sec	$10^{18} \text{ }^{\circ}\text{K}$	The explosion described by the Big Bang Theory takes place at about this time. Radiation dominates. Quarks – antiquarks form.
$10^{-3}$ Sec	$10^{14} \text{ }^{\circ}\text{K}$	Protons and Neutrons (sub-atomic particles) form from quarks.

1 Sec	$10^{10} \text{ }^{\circ}\text{K}$	Stable Nuclei of protons and neutrons form.
100 Sec to 3 Min	$10^9 \text{ }^{\circ}\text{K}$	Hydrogen, Helium and Lithium form.
1 Month	$10^7 \text{ }^{\circ}\text{K}$	Cosmic Microwave Background (CMB) spectrum Fixed.
10,000 Yrs	20,000 $^{\circ}\text{K}$	More and more Matter is being created. Energies of Radiation and Matter tend to be about the same.
380,000 Yrs	3,000 $^{\circ}\text{K}$	Cosmic Microwave Radiation last scattering occurs.
1 Billion Yrs		Hydrogen gas is pulled together by gravity until the force causes the gas to collapse and ignite through hydrogen fusion to form the first stars. The stars explode as Supernovae when there is an imbalance in their gravitational and nuclear forces, spewing out heavier elements into space. Blackholes, various remnant stars form.
2 Billion Yrs		Galaxies begin to form.
9.2 Billion Yrs		Solar System forms. The Sun is 4.5 billion years old and has approximately another five billion years of life.
13.7 Billion Yrs		This is our present. The age of the universe as given here is the best estimate based on different methods. It may be wrong by several hundred million years this way or that. Galaxies and stars continue to form, collide, explode or merge. Over 150 systems like our Sun and around 236 extra-solar planets are noticed till May 2007. One planet (about one and half times bigger than earth) around a red star in the Libra Constellation is particularly expected to have liquid water and hence possibly life.

## **2. WHAT MAKES UP THE MATTER IN THE UNIVERSE?**

A variety of living and nonliving objects surround us. Invisible to the eye is air. Up in the sky are stars and planets. All of it is matter. The matter that we can see, touch, smell and taste is composed of chemical elements. To date, 118 elements have been discovered. Hydrogen is the simplest element with one proton (positive charge) encircled by one electron (negative charge). Other elements have more protons and electrons.

The animate world is made up of mainly the elements oxygen, carbon, hydrogen, nitrogen, calcium, phosphorus, potassium, and sodium. The rocks on the earth have oxygen, silicon, aluminum, iron, calcium, sodium, potassium, magnesium, etc. Earth has a core of iron and nickel. The nearest heavenly body to us, the moon, has rocks that resemble the Deccan traps in India. The Mars has oxygen and iron bearing rocks similar to those in Orissa and Bihar. The Cassini probe showed in April 2005 that Titan, one of Saturn's moons has carbon and hydrogen. "Titan is just covered in carbon-bearing material—it's a giant factory of organic chemicals," said Dr. Lorenz of John Hopkins University. "This vast carbon inventory is an important window into the geology and climate history of Titan. At minus 179° C, instead of water, liquid hydrocarbons in the form of methane and ethane are present on the Titan's surface, and tholins probably make up its dunes", as per a report in 2008. Tholins are large carbon molecules that are supposed to be precursors to biomolecules that make up living organisms. The eight planets in the Solar system (Pluto is not any more classified as a Planet as per the recent definition of Astronomers) have the same type of elements that occur on the earth, though the elements may be in different proportions on those planets. Dr. G. Tinetti and coworkers identified in July 2007 clear signs of water on planet HD 189733b located 63 light years away in the constellation Vulpecula. A rocky planet nearly four times the size of Earth was found orbiting the Red Dwarf Star Gliese 436 (about 30 light years away) with an atmosphere of hydrogen and helium. Astronomers from the University of California reported in 2007 that "the relative abundance of elements in the atmosphere of a white dwarf star known as GD 362 in Hercules Constellation (150 light years away from Earth) to be similar to those in our Earth-Moon system." A star (41 light years away from us) was found to have five planets and



one of them is suspected to have liquid water like the earth as reported by Prof. G. Marcy in late 2007. Dr. Scott Gaudi, of Ohio State University reported in 2008 that "An international team of astronomers has discovered two planets that resemble smaller versions of Jupiter and Saturn in a solar system nearly 5,000 light years away. The find suggests that our galaxy hosts many planetary systems like our own." Thus the matter content of other astronomical bodies resembles what we know on the earth.

Hydrogen is the most abundant element in the Universe. Next is helium. Oxygen occupies a distant third place. Hydrogen was formed when our universe came into existence about 13.7 billion years ago, -an event called "The Big Bang". Helium and a little amount of lithium also formed at that time. The rest of the elements are built in stars by fusion. According to Dr. Robert Janssens of Argonne's Physics Division, "Every element in the universe has its origins in the stars and explosions that started billions of years ago and are still going on today." He further adds that "We've only seen half of the isotopes that we believe actually exist," and investigations are on to look for new ones because about 50 percent of the elements in the universe heavier than iron are created in this area of unstable isotopes.

The Solar System came into existence about 4.5 billion years ago from the remnants of previously existing stars that exploded spewing out the elements within them as dust into space. Thus, you and I are made up of stardust of atoms, which originally formed millions of years ago somewhere in the galaxy. They were used and reused many times in various rocks, minerals, animals and plants before entering our bodies! It is quite possible that a carbon atom now sitting in your body could have once been in the gut of Yudhistir or even Rama!

Sun is one of the hundred billion stars within the Milky Way Galaxy. Milky Way Galaxy stretches 100,000 light years across. It, along with Andromeda Galaxy, the Magellanic Clouds, Triangulum and 20 other galaxies forms the Local Cluster. Several such Local Clusters form a Super Cluster. Ursa Major (Sapta Rishis), Coma Berenices, Leo and Virgo clusters are members of our Super Cluster. There are billions of Super Clusters in the visible Universe. The most distant object we could see would now be about 13.7 billion light-years away from us, the distance light could have traveled in the 13.7 billion years since the Big Bang. But because the universe is expanding, the current distance to the most distant object we can see is more than three times farther, or 46 billion light-years.

Further, one has to remember that, as Professors C.H. Lineweaver and T. M. Davis say, "Observers living in the Andromeda Galaxy and beyond have their own observable universes that are different from but overlapping with ours. Andromedans can see galaxies we cannot, simply by virtue of being slightly closer to them." Thus the universe is too vast to conceive. But surprisingly, matter is still rare - there is about only one atom per 10 cubic meters of space!

Just as the earth is revolving around the Sun, the Solar System is revolving around the center of the Milky Way Galaxy. The Sun moves at 250 km per sec and takes 200 million years (a Galactic Year) to complete one orbit around the galaxy.

The Andromeda Galaxy is two million light years away and is moving towards the Milky Way at a speed of 100 km per sec. Such speeds and the gravitational pulls of the Galaxies within their local Clusters show that the mass of the visible stars in them is too inadequate to balance the dynamics. There has to be heavier matter but invisible to us at the outer fringes of the galaxies. The missing matter, named "Dark Matter", is calculated to be at least 22 per cent of the universe. Research on "Dark Matter" ranks among the hottest topics in modern physics. Dr H. Araujo writes, "Recent astrophysical data support the idea that Dark Matter may be made of as yet undetected weakly (W) interacting (I) massive (M) particles (P) or WIMPs. The WIMPs may be heavier than the largest stable atoms, and we think that they might float about in halos around galaxies, including our own."

The Universe has been expanding like an inflated balloon. In less than a minute, the universe increases its volume by a trillion cubic light-years. This expansion is going on defying gravity. The negative gravitational force seems to increase with distance. Present day laws of physics are inadequate to explain the nature of such a force. It is aptly named as "Dark Energy". This "Dark Energy" forms the bulk of the Universe, as much as 74 per cent. Some scientists postulated the existence of an all-pervading "Quintessence" (the fifth element, following the Greek philosophers) that exerts a negative pressure on galaxies.

Thus, we do not have much information about 96 per cent (22 % Dark Matter plus 74% Dark Energy) of what constitutes the Universe. Out of the balance of four per cent, more than three per cent is nonluminous matter like hydrogen and interstellar gas. So what we know and see around us as visible (luminous) matter is less than one per cent!

Still the story does not end here. The simplest of the atoms is hydrogen with a positive charge surrounded by a negative charge. There is no reason why a negative charge cannot be surrounded by a positive charge. Indeed a form of hydrogen does occur this way. The particle physicists have produced it in the lab. They call it 'antihydrogen'. As a matter of fact, all matter can occur in its corresponding antimatter form. (May be there is one anti-Ramesam writing an anti-article and an anti-You reading it somewhere in the Universe!).

After the universe originated in the Bing Bang, matter and antimatter were created equally in the first few minutes when the universe was still hotter than a billion degrees centigrade. But matter and not antimatter predominates in the universe. Some of the recent theoretical and experimental work shows that antimatter could have disintegrated faster leaving slightly excess of matter. It is also possible that there are other universes existing with antimatter and a different physics. As photons and antiphotons are indistinguishable, we have no way to know if some of the light (photons) we notice is emitted by antimatter.

Physicists have described at subatomic particle level fermions, which occupy space and bosons, which give rise to force. Some physicists dealing with consciousness believe that consciousness is also a fundamental property of all matter. The ancient Greek philosophers considered the world to be made up of four elements – earth, water, fire and air. The Hindu sages thought of the world as an admixture of Pancha Bhutas (five elements) – earth, water, fire, air and space. Dr. P. Gradinarov described the sequence for the evolution of matter as per the methodological principles (*tattvas*) of Sankya Philosophy. The generation of matter as per the Sankhya Model is: *Satva - Rajas - Tamas (trigunas)* give rise to *Tanmatras*, which in turn produce *Paramanu* (atoms) which combine to form *Sukshma* and *Sthula Bhutani* (matter).

It is not clear what our ancient sages understood (if they did) about all the 118 elements, antimatter, Dark Matter and Dark Energy or fermions and bosons. However, Gita exhorts us to go beyond the three *gunas* (Chapter II, Sloka 45) and the ritualistic life in order to understand the supreme Truth.

### 3. YOU DON'T BELONG HERE

The ballet of twinkling stars on the humongous stage of clear night skies is a breathtaking sight that enchants and entralls us at the same time. You lose your 'self' watching that infinite symphony as if you unexpectedly found your long-lost cousins.

Man has tamed the earth. Carved a comfortable niche for himself/herself on it. Brought starry designs down to earth. Still he looks up. Looks up with a sense of 'unfulfilment'. A gnawing feeling of a "void" haunts as if something is being missed here. 'Do I really belong here on earth? Where have I come from?' question keep coming back to us.

I could go back to seven generations to Shri Vemuri Naganna (c.1750) who was my great, great...grandfather. May be in your case you may go back to the Mahabharata times. But that ancient person too was a child of his parents. Who was our ultimate ancestor?

We may start with the building blocks of our life — genes, the long chains of a few compounds present in every cell of our body. Information about us (the number and type of proteins that make us what we are) is stored in genes and copied to the offspring. We can, hence, reach our ancestor tracing back our genes. But the genes in you, I, the lowly worm in your garden, and the dog on your leash or the flower you adore your god with are all same! Occasional accidents in copying produce a variation or some times a new organism. Prof. De Duve, Nobel Laureate says, "There is now overwhelming evidence that all known living beings are descendants through evolution from a single ancestral form of life."

Archea is the most ancestral form of life known. Some scientists say that Archea along with a few other microbes came out of another single ancestor. They call it the "Last Universal Common Ancestor (LUCA)." So LUCA, the creature with the simplest of gene expression, must have been OUR great grand ancestor. The question still raises – where did LUCA come from? Vyasa expressed in 16 words the origin of living beings (Bhagavad-Gita – Chapter III, Slokas: 14-15). It's too cryptic and incomplete. Let us see what science says beginning at the very beginning.

The earth coalesced into shape along with other planets from hot, fast moving chunks of flotsam and jetsam while the sun gathered his mass from a huge cosmic cloud of gas and dust. That was about 4.5 billion year ago. Comets brought water to the earth. Life on earth could have begun and got obliterated more than once as the earth went through episodes of crustal melting and intense bombardment from space debris. The oldest rocks on earth are 4 billion years old. We have indicative evidence of life in rocks that are 3.85 billion years old. Fossil bacterial colonies are present in rocks that are 3.5 billion years old from Australia. But atmospheric oxygen appeared only from about 2.3 billion years ago, produced by the photosynthetic activity of Cyanobacteria. The initial excess oxygen so produced burnt iron into its oxide resulting in the vast banded ironstone formations that occur in India and other countries.

So the first life on earth could not have been breathing oxygen! Nor did it depend on Sun's light. We have such queer creatures existing even today – near geothermal vents several miles below the ocean surface, in the Pacific and Atlantic. Green sulfur bacteria breathe hydrogen sulphide, live on chemical energy. They have for company at that depth eyeless shrimps, ghostly crabs, football-size clams, human-size tubeworms thriving at 370 °C! Archea too was such an organism loving extreme conditions. We, therefore, call them "Extremophiles". Only difference is they think that we are Extremophiles!

Interstellar and intergalactic space contains many compounds that are precursors to the building blocks of life. Scientific literature contains several recent reports. For example:

1. 'The Cassini Probe orbiting Saturn detected hydrocarbons on Hyperion (Satellite of Saturn). Hydrocarbons i.e. combinations of carbon and hydrogen atoms are found in comets, meteorites, and the dust in our galaxy," said Dr. Dale Cruikshank, a planetary scientist in July 2007. "These molecules, when embedded in ice and exposed to ultraviolet light, form new molecules of biological significance. [So] it is a further indication that the basic chemistry needed for life is widespread in the universe."
2. Astronomers from Arecibo Observatory radio telescope "detected in 2008 for the first time the molecules methanimine and hydrogen cyanide — two ingredients that build life-forming amino acids — in a galaxy some 250 million light years away."

3. The Hubble Telescope made the first detection of an organic molecule in the atmosphere of a planet orbiting another star in March 2008. "This is a crucial stepping stone to eventually characterizing prebiotic molecules on planets where life could exist", said Dr. Mark Swain of NASA's Jet Propulsion Laboratory, USA. The planet HD 189733b, now known to have methane and water vapor, is located 63 light-years away in the constellation Vulpecula, the little fox.
4. Researchers from the Max Planck Institute for Radio Astronomy in Bonn have detected in March 2008 a molecule closely related to an amino acid within the star forming region of Sagittarius B2. Glycolaldehyde, a sugar molecule was detected in a large cloud of gas and dust some 26,000 light-years away, near the center of our Galaxy. So far, about 140 different molecules have been discovered in these clouds.
5. Dr. Zita Martins of Imperial College London published in June 2008 her discovery of an important component of early genetic material which has been found in Australian Murchison meteorite fragments. The scientists say that this "research provides evidence that life's raw materials came from sources beyond the Earth. The materials they have found include the molecules uracil and xanthine, which are precursors to the molecules that make up DNA and RNA."
6. Dr. S. I. Groth and others of Instituto Astrofísica de Canarias reported in September 2008 "presence of naphthalene cation in a cloud of interstellar matter located 700 light-years from the Earth." Their report also says, "When subjected to ultraviolet radiation and combined with water and ammonium, (both very abundant in the interstellar medium), naphthalene is capable of producing a wide variety of amino acids and also precursor molecules to vitamins. All these molecules play a fundamental role in the development of life as we know it on Earth. In fact, naphthalene has been found in meteorites that continue to fall to the surface of the Earth. [Such meteorites] fell with much greater intensity during the epochs preceding the appearance of life." The illustration on the cover shows the artist's depiction of naphthalene in stellar space (Courtesy: *Gabriel Pérez* (Instituto de Astrofísica de Canarias)).

We have reports of basic building blocks required for life to be present here right on the earth itself. Evidence of “hydrocarbon - molecules critical to life – being generated by the simple interaction of seawater with the rocks under the Lost City hydrothermal vent field in the mid-Atlantic Ocean” at a depth of 2600 feet was found by scientists of University of Washington in February 2008. Dr. Katrina Edwards and others surmised in May 2008 that reactions within the rocks themselves might offer fuel for life because the oceanic crust supports more bacteria compared with overlying water.

Thus, ingredients to form the basic constituents (amino acids) for life are available in interstellar space, deep-sea vents or pools on primitive earth’s surface. Scientists could synthesize organic compounds used by living things in laboratory simulating all the three environments.

Where life did actually arise from? Your guess is as good as anybody’s, for, arguments can be bolstered up equally on all sides. I shall, however, present below my glib version.

If you traveled around the country (before globalization and TV homogenized everything), you would see that houses were typically made up of locally available material – whether tree leaves, sandstone, slates or granites. Similarly, if life originated on earth, one would expect it to be made up of predominantly the chemical elements generally available on earth. Earth’s crust is mainly oxygen, iron, silicon, aluminum, and magnesium. Seawater contains chlorine, sodium, sulfur, calcium and potassium. In contrast, all living beings on earth or oceans consist mainly of four chemical elements: hydrogen, oxygen, carbon and nitrogen. (All the other elements contribute less than one percent of mass). “The distribution of the elements in life on earth resembles the composition of the stars far more than that of the Earth itself.”

The main food synthesized and used by all living creatures on earth (whether the extremophiles or plants or us) is carbohydrates – combination of carbon, hydrogen and oxygen. Not silica, iron and other elements available in plenty on earth. Talking of food, you cannot digest by yourself the food you eat, had our non-oxygen-breathing ancestors been not lovingly helping you! Sitting in the dark, caustic/acidic oxygenless recesses of our stomach or intestines, they (acidophilus, lactobacillus, bifidus) help convert all that poison you eat to a usable

form. Did Vyasa not indicate that our original ancestor Vaiswanara helps us in digesting what we eat?

*“Aham vaiswanarobutwa praninam deha maasritah,  
.....pachamyannam chaturvidham”*

— (Bhagawad-Gita, Chapter 15, Sloka 14)

We cannot live without oxygen now. But oxygen was your and at any rate your ancestor's enemy! Take your body, *Deha* for instance. In Sanskrit, *Deha* is derived from *Dahyati iti Dehah* – that which gets burnt away (oxidized). The body is not you. It's only a protective shield against oxygen for you. So the real you is different than your body. Actually you take antioxidants for your health.

“Dust thou art, and unto dust shalt thou return (Gen 3:19).” We come from cosmic dust. The house dust is mostly dead skin. [It is also interesting to note as an aside that stars require lithium element to burn and shine. Some humans take lithium to keep up their spirit and shine.]

French philosopher Pierre Teilhard de Chardin once remarked, “We are not physical beings having a spiritual experience, but spiritual beings having a physical experience.” Prof. Lucy Ziurys of Arizona University says, “The origin of organic material on Earth — the chemical compounds that make up you and me — probably came from interstellar space. One can say that life's origins really begin in chemistry around objects like VY Canis Majoris, an old star about 5,000 light years away.”

No wonder you feel déjà vu looking up. You don't belong here on earth!



## **4. HORMONES AND SWINGS IN EMOTIONS**

All of us feel good or bad, experience likes or dislikes, get attracted or repelled, feel enthusiastic or disgusted. In other words, we witness many swings in emotions. Even when we know we should not exhibit these emotions, we seem unable to. What are these emotions and what controls them and why are they there if they are not wanted by us?

We do not know what life is or where from it came. But life-forms, the carriers of "life", evolved over millennia of years from a primitive organism to the man we know now. At every stage of its development, the creature has to ensure its own safety, security and comfort in order to perpetuate itself and carry forward "life". Emotions are one of the many tools that help the individual in his/her survival. They facilitate quick decision-making mechanisms in the body in responding fast to an external hostile threat or a favorable situation. Emotions also serve as a way of quick communication amongst the members of a species for collective effort in facing a perceived threat. New born babies too communicate using emotions (crying or smiling). From the angle of communication, emotions can be considered as precursors to language. No wonder, even today our communication is over 90 per cent non-verbal and is highly linked to body expressions connected with emotions.

There is a clear relationship between the type of hormone (a protein) that is produced in our body and the type of emotion felt by us. The hormones are secreted by the endocrine glands directly into the body organs. The endocrine system comprises gonads, adrenal gland, pancreas, thymus, parathyroid, thyroid, pineal and pituitary glands. The pituitary is the master controller. The instructions from it are carried by neurotransmitters across nerve connections called synapses. Examples for the chemicals, which act as neurotransmitters are serotonin, dopamine, epinephrine, norepinephrine. Testosterone, estrogen, androgen, insulin, oxytocin, thyroxine, somatotropin, glucocorticoids, etc are examples of hormones. In general, the level of the hormone reached in the blood provides a feedback to the pituitary for giving further instructions to the glands either to continue production of a hormone or to stop it. The locations of the seven endocrine glands in the body correspond to the locations of the seven chakras identified in the Kundalini.

The hormones suited the primitive man, as the instinctual behavior pattern triggered by the emotions has evolved to enable him or her to suitably face a hazardous or favorable situation in the caveman age. The route followed by emotions provides a faster inferential short-circuit in responding to a situation than that of using our analytical ability. The most basic emotions are two, namely (a) fear and its derivatives and (b) love and its manifestations. Fear and its forms like anger, competitiveness, etc are produced by mainly adrenaline. Love is a lumped up term used by us to describe the feelings of lust, affection, attachment, sharing etc. Love as lust (with sexual urge) is generated by testosterone, love as affection by dopamine and love as attachment (friendship) by oxytocin (produced by the pituitary). Studies at the University of Pisa, Italy showed that romance is akin to obsessive compulsive behavioral disorder with high levels of dopamine and norepinephrine and low levels of serotonin. The thymus gland near the heart functions only during the growth phase of a child and later it becomes inactive. The reproductive hormones too work only for certain period. But the rest of the glands continue to function in one way or other all through our lifetime.

High serotonin and norepinephrine levels were necessary for a primitive man living in forests in order to courageously face an adverse situation with focus. But a behavior triggered by these hormones is often dubbed in the present day society as aggressive. When a person is in euphoria, he has high levels of testosterone and the behavior becomes infectious too. The fire cracker euphoria after an Indo-Pak cricket match is an example. The testosterone levels go up not only in the players but in the viewers too!

The primitive man and woman used to attain puberty much later in age and they faced mortality too soon. Therefore, they had a narrow range of reproductive life period. In the modern age, puberty is coming much earlier. Even before the child is ready for reproduction, there is a sexual urge. Old age is too delayed because of improving medical and health care. Both these have contributed to an effective increased span of reproductive age. Consequently, new problems are cropping up with respect to stabilization of population in relation to the bearing capacity of the resources and management of aging population.

When the body needs rest, melatonin is secreted. We wake up when cortisones are secreted. The flight duty personnel or shift

workers, for example, are required to perform at the same level of efficiency irrespective of their body chemistry. As per the natural body requirements, when it needs rest, the body automatically produces melatonin. But because the person is on some critical professional duty, he/she has to keep awake and force the body to produce cortisone. This produces a conflict in their bodies and can create health problems in the long run.

The feeling of disgust too has its origin as a survival tool. It helps avoiding unwanted environments and ensures we seek amicable surroundings that contribute to our growth and development. Dr. P. Goldin says that difficulties in regulating our emotions could be the cause behind many mood and anxiety disorders. A potentially upsetting situation can be given a less-threatening meaning by a reappraisal by our prefrontal cortex (brain behind eye brows). Such a reappraisal will provide a quick a sense of well-being. On the contrary mere suppression of the emotion through control involves the emotional centers like amygdale. This process covers up the stress leaving the person still vulnerable as reported by Dr. Goldin and his colleagues.

University of Cambridge scientists said in a report in April 2008 that “steroids naturally produced in the body (specifically testosterone and cortisol) may provide insight into why people caught up in bubbles and crashes often find it difficult to make rational choices, unintentionally exacerbating financial crises.” They further state that “Testosterone is a steroid hormone which controls competitive encounters as well as sexual behaviour. Testosterone in male athletes, for example, will rise prior to a competition and rise even further in a winning athlete (but decrease in a losing one). This increase of testosterone in the winner can increase confidence and risk taking and improve chances of winning yet again, leading to a positive-feedback loop termed the ‘winner effect’. However, too much testosterone can have a detrimental affect on the ability to assess risk rationally.” The researchers suggest that rising cortisol levels can reduce appetite for risk: that is, affect a trader’s risk taking in the opposite direction to testosterone. Cortisol is known to have powerful cognitive and emotional effects. Amongst these effects are heightened memory for adverse events, and alteration in mood.

In the late 1990s Mr. LeDoux’s and others showed through magnetic resonance imaging (MRI) studies that different parts of the brain are associated with different sorts of emotional and decision-making activity. Thus our brain constantly senses the environment

and produces hormones that naturally protect us. So hormones are not under our conscious control and are not really suitable to the present day living. The expected (required) behavioral norms of group living developed by the human beings are at variance with the hormone-induced emotions that were acquired for a life in the jungle. Our old (evolutionarily) brain keeps on producing them and keeps sending instructions to different organs. Therefore, the individual is in constant conflict with what the brain tells the organs to do and what our educated reasoning requires us to do.

A conflict of purpose induces unhappiness, sorrow and depression because of an imbalance in dopamine, serotonin, etc. Arjun (as portrayed by Vyasa in the first chapter of Bhagavad-Gita) faced a state of depression when there was a conflict in his mind. In order not only to attain a balanced state of mind free from conflict, but also to succeed as a group, there is a need to negate the effects of these hormones. Bhagavad-Gita is a lesson in obtaining such an emotional maturity and balanced mind.

## 5. THREE MYTHS

We take for granted many statements handed over to us by tradition and traditional Gurus. But should we? Here let us look at three such statements and find out.

### (I) MAN IS THE ULTIMTE FORM OF CREATION

We have evidence of microbial life of the simplest type from rocks as old as 3,500 million years. From then on, the organisms evolved into complex forms adopting a variety of survival mechanisms so that they can pass on their genes to their offspring before they are dead. There was an explosion of life forms around 550 million years ago. But at no time a particular species was important or a necessary condition for "Life" to exist or continue

Graptolites in the Silurian, a variety of fish in the Devonian and several reptiles towards the end of the Paleozoic Era (350 million years ago) reigned supreme in their respective periods but became extinct later. The dinosaurs ruled the earth as the unquestioned highest forms of life for about 160 million years. But at the end of Cretaceous (about 70 million years ago), all the dinosaurs disappeared, though life itself did not get extinguished. Life continued into other forms. The huge mammoths were everywhere on the earth till geologically Recent times (about a million years ago). But they exist no more.

In the long history of life on earth, there have been many examples of mass extinction of several animals and plants and evolution of new creatures. "Since the advent of life on Earth 3.5 billion years ago, scientists think there may have been as many as 23 mass extinction events, many involving simple forms of life such as single-celled microorganisms. During the past 540 million years, there have been five well-documented mass extinctions, primarily of marine plants and animals, with as many as 75-95 percent of species lost."

Today a human being appears to be the unquestioned ruler of the world blessed with a big cranial capacity and rich consciousness unsurpassed in the past. Whatever steps we may take, there is no sure way to say that the human being is going to be there on the earth for ever and ever. Nor can one say with any reason that the ultimate form into which life has evolved is Man. Nor does the earth look to be

the only planet to support life. In early 2004, a planet in the Pegasus cluster was identified with carbon and oxygen escaping from it. Very recently a planet about one and half times the size of earth is supposed to be orbiting a red dwarf star in the Libra constellation sufficiently away from the star to be able to contain liquid water. There is a good possibility to expect life on this planet. The star is about 20 light years away from the earth.

Thus the earth cannot claim carbon (and hence carbon based life) as unique for herself. The movement of "Life" continues from one species to another. 'Life' appears to be a self-perpetuating movement from somewhere unknown to an unknown nowhere, manifesting inside highly organized auto-cannibalizing and evolving life-forms, matter and species being merely incidental intermediaries in this movement. There does not appear to be an end to this movement and one cannot predict what form and shape the future creatures take. Therefore, Man is just one form of the species for "Life" to continue for the present. The Homo sapiens may some day become expendable just as the dinosaurs were.

## (2) IT IS NATURAL TO BE NON-VIOLENT:

Nonviolence is an asset for the smooth living of a group of people. Otherwise, the group can destroy itself totally by inter and intra-group violence. But non-violence does not exist in nature. In fact, it's violence that is prevalent.

Every creature needs to eat to live. How does it secure its nutrition? Is it by love and nonviolence? No. It is by naked and even fierce exploitation of the weak. Watch how each of the prey tries to run away from its predator - whether it is a cruel chase of a bison by a pack of leopards in the wild or the silent chase of a roach by a lizard in a house. The run for its life by the prey is most pitiable. But there is no possibility of life to continue without this predator-prey "life and death" fight, which can hardly be described as nonviolent. Though vegetarianism apparently does not look so violent, it too causes its worries to the plants. Of course, we have bees living on the nectar from flowers and other forms of symbiotic life. But in the overall progressive tree of evolution, predator pyramid is the rule. The bees do consume bacteria as food. They reached a "dead end" branch in evolution millions of years ago.

Non-violence is a unifying force but not a destructive one. But the very act of devouring something is an irretrievable destruction of whatever is.

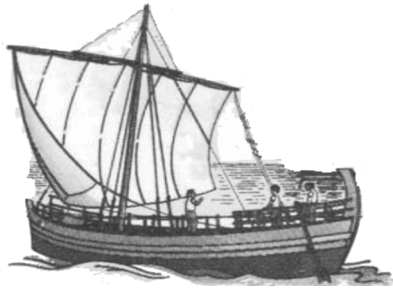
Note also how our body manages to stay alive. We are bombarded by a variety of micro-organisms and viruses all the time when we are alive or dead. The body is not suddenly exposed to a new set of germs after our death. They have been there all the time. But a dead body rots so soon because of these microbes and germs. When we are alive, there is an incessant 'fight to kill' with them by our immunological mechanisms. It can hardly be described as nonviolence unless we give a limited definition to the word "nonviolence" keeping our own well being at the center of such a definition. When we die, our body loses this capacity to fight and soon the microbes and germs take over.

### (3) LOVE AND FEAR ARE OPPOSITES:

Love is preached to be cultivated and fear to be abhorred. (As used here, love includes all its other manifestations like mercy, kindness, forgiveness, affection, sharing, cooperation, etc. So also fear includes all its variations like anger, hatred, envy, competitiveness and revenge). But these two feelings have the same single and identical purpose of facilitating self-preservation and self-perpetuation. Fear helps in the self-perpetuation and survival of the individual whereas love helps in the self-perpetuation of a group - family at one level or the whole species in a larger sense.

In the non-zero sum game of Prisoner's Dilemma, the economists demonstrate how cooperation (i.e. love or care for other's needs) rather than competition leads to the highest common good. Thus love in all its manifestations assures the highest common good and helps in the survival of a group as a whole. If love for one another amongst the members of a group, society, or clan is absent, that group would have annihilated itself by internal quarrels and fights. So-called altruism thus helps towards the propagation and perpetuation of the species at the cost of an individual who is motivated to sacrifice himself/herself invoking some ideals.

## 6. SHIP OF THESEUS



If you weigh 70 kgs, you have seven billion billion billion (7 followed by 27 zeros) atoms in you. They constitute hundred trillion different types of cells – cells of skin, blood, muscle, bone, hair etc. that make up your body. The cells are not fixed. They are in constant flux. Old ones die and new ones are made all the time. Each minute 350 million red blood cells get replaced with new ones. Every minute, 30,000 of our outermost skin cells die so that we can live. You get a new stomach lining every five days. Entire skin gets replaced every 4-5 weeks. Liver cells are recycled in six weeks. Even the solid looking skeleton is replaced once in three months. Things are no different in the brain. Dr. J. McCrone says, “The half-life of the protein filaments of a neuron is just ten minutes. The protein – packed zone that powers synaptic activity is replaced molecule for molecule, almost by the hour.” Each moment you breathe out, as Dr. Deepak Chopra puts it, “atoms of hydrogen, oxygen, carbon, and nitrogen that just an instant before were locked up in solid matter in your body are vanishing into thin air.” By the end of a year, 98 percent of the atoms in your body will change. The child that you were is gone and dead long ago. In the midst of all this change, how do ‘you’ know you are “you”? Is there an identity that is independent of the ever-changing parts you can call “you”?

Let us imagine the case of a wooden ship. It is afloat and sailing. But over a period of time, the boards and all parts are gradually replaced until finally there is not a single board or screw left from the original ship. Is it now the same ship? You may think so because the ship is still on the seas and functioning. But consider this. Say, somebody follows your ship and gathers up meticulously all the discarded boards and parts. He constructs a ship out of them that contains all and only



the parts of the ship that was originally launched, so that every single board in the second ship is identical with a board that was in the ship as originally launched. Which is the ship we originally started with? Is it the one that has the continuity of function and is still carrying you or is it the one that has continuity of having the original parts? Which one does an antique dealer value as the original? So which is really you – the continuously changing ‘you’ or the body of cells, which disappeared?

You may say that even if somebody assembled another person using all your discarded body cells, its not you because the reassembled person did not have an existence prior to the assemblage. This argument does not hold water. Suppose you dismantle your bicycle into its parts and reassemble them at a distant place after transshipment. While the packed bicycle was under transit, it had no existence as a bicycle. The reassembled bike, therefore, did not have a prior existence. Can we then claim that the reassembled bike is different from the first one simply because it did not have an immediately preceding continuity of existence?

Invoking the memory of your past does not solve the problem either, for the argument becomes circular. As Prof. Searle said, “We cannot explain personal identity in terms of memory, because the memory in question presupposes the very identity that we are trying to explain.” It is like asking the culprit to give evidence. Further, are we not aware how reliable is our memory? We hardly remember in our thirties anything of our childhood. We remember nothing much in our sixties of what went on when we were thirty. Why go thus far, do you remember what you had for lunch and supper just a week ago? Did you not walk back out of a room simply because you forgot why you had entered it in the first instance? The mind has its own bag of tricks and memory is hardly reliable to bank upon for our judgment.

To further confound matters: suppose you are teleported atom by atom to another place. You disintegrate at the first place and the information on “you” is sent to a distant place where “you” get reassembled there. Are “you” still you? Or let us say that instead of disintegrating your original body, an exact copy of you is cloned in such a way that one cannot distinguish the two. Which is you, the copy or the original?

Heraclitus was a Greek philosopher slightly later than Buddha. Theseus was a Greek mythological hero who set sail in his ship to kill a monster. The “Ship of Theseus” is a version of a puzzle posed by Heraclitus on the question of identity. The ship we talked about in the beginning is his ship. The story shows that spatio-temporal continuity, persistence of parts, and / or memory, as the philosophers would say, are inadequate arguments for establishing one’s identity.

Though the USA has the highest trade deficit (\$ 850 billion) today in the world, the greenback commands more confidence because of an image the US dollar carries. Our notion of persistence (and continuity) is woven like that economic web of illusion. We feel something has got to be there; but can hardly put our finger on it. Vyasa, following our Upanishads, says that beyond all change, there is something all-pervading, unchanging, unmanifested and unthinkable (Bhagavad-Gita, 11, 25-26). Buddhists would call it emptiness. Quantum physics indicates the existence of ‘boiling’ vacuum. Whatever it is, what we can see easily is that “life” continues in the constantly re-formed “us”. Even if someone cleverly reassembled us using our discarded cells, we do not know if the reassembled body would have life.

So it is not exactly ‘I’ that continues in my body. It is “life”! This brings us to another interesting point. I don’t have a different “type of life” in me from the “life” in you. “Life” itself is the same in all. However, what is “Life” and what exists beyond Life makes another story.

## 7. THE POWER OF THINKING

Our great ancient sages maintained that the whole universe is nothing but a thought. It is truly an intriguing statement about the world around us. Until recently science had no way of understanding these words. But thanks to the accumulating research on brain and consciousness, we have some insight.

Brain is the seat for all thoughts. Our brain weighs about 1,400 gm (less than 2 per cent of the body weight); but consumes 20 to 25 per cent of our daily intake of energy. There are 100 billion neurons and several billion glial cells in the brain. Each neuron has up to 10,000 connections giving rise to an enormous capacity to process information. Latest studies suggest that glial cells may be nearly as critical to thinking and learning as neurons are. There is a fallacy that we use only 10 per cent of our brain. It is not true. There is no fallow brain capacity lying waste.

The connections of the neurons are constantly modified throughout our lifetime. Some of the wrong connections or extra connections may result either in debility or uncommon skills for the individual. Because of wrong neuronal connections, while one hand tries to place an object on the table, the other hand keeps on removing it. Extra connections in the neurons of different brain regions make certain people see different colors instead of numerals – every time they see number one, it appears blue for them, two may be yellow, seven may be red and so on.

The neuronal activity in the brain associated with thinking, learning, relaxing et cetera, produces electrical fields. An example of the electrical field recorded in the form of waves by Electroencephalograph (EEG) is shown in Figure I. Scientists are now able to harness the energy of such waves to propel a wheelchair. A handicapped person by mere thoughts like “go straight”, “turn left”, “turn right” can move his/her chair. Experiments at Armstrong Laboratory’s alternative control technology lab have unleashed the energy of brain waves, to command a flight simulator to roll left or right. Robotic arms were manipulated by macaque monkeys by mere thoughts to feed themselves without moving their own arms. Says Dr. A. Schwartz of Pittsburgh University, “Just by thinking about picking up and bringing the fruit to its mouth, the animal fed itself.” Recently

Prof. C. M. Higgins of Arizona University and his coworker exploited the electrical signals from a single neuron in the rice-grain-size brain of a moth to move a robot.

How about controlling videogames with your thoughts instead of hands? Emotiv Systems Inc. plans to start selling the \$299 EPOC neuroheadset to let you do just that by later 2008. "The headset's sensors are designed to detect conscious thoughts and expressions as well as "non-conscious emotions" by reading electrical signals around the brain, says the company, which demonstrated the wireless gadget at the Game Developers Conference in San Francisco."

Still more amazing is the public experiment designed by Dr. David Sulzer, Columbia University Neuroscientist. "With electrode-studded headbands strapped to their scalps, three percussionists banged out a cacophony of sound and rhythm at the performance in New York in March 2008. The musicians' brainwaves traveled through the air, triggering the tones." These experiments demonstrate Sulzer's idea that thinking about an action stimulates the brain in much the same way as actually carrying it out.

In May 2008, a team of researchers from Taiwan has designed a baseball cap with the goal of making it convenient and easy to use in everyday life. When you put it on, the cap detects and analyzes the electroencephalogram (EEG) signals from your brain to control home electronics such as TVs, computers, etc. by just thinking about them.



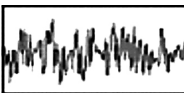
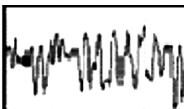
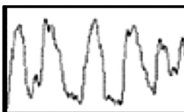
Waves	State	Cycles / Sec (Hz)	Activity	Wave Pattern
Gamma	Thinking	40	Information processing REM sleep	
Beta	Alert / Wakeful	13-40	Active ; focused	
Alpha	Relaxed	8-12	Creative; Sense of Well-being	
Theta	Drowsy	4-8	Meditative; Slow down; Almost Sleep-like	
Delta	Deep sleep	0.1-4	Deep Sleep; Trans-like; (Growth Hormones are released during deep sleep state.)	

Fig 1. : Brain Waves

A group thinking together has more strength to influence an outcome. By their concentration, the group could achieve a specific picture to be produced by a computer out of many that could be randomly generated. Sports managers exploit this aspect of 'group thinking' to motivate their teams to win a game. Another example of the power of thinking is in the control of physical pain. By mere pre-suggestion evoking a positive thought (placebo) or with diversion of attention, pain is not felt by an individual, though the signals of pain are still received in the brain. Thus thought has the capacity to rid us of the pain.

Prof. Gardenfors (a Swedish linguist) says in his book ***How Homo Became Sapiens*** (2003), "First came sensations, then attention, followed by emotions, memory, then thoughts, then planning, and later

the self.” Thoughts are the internal representations in our brain of the external world. Organisms have to constantly face “here and now” dangers in their life. Psychologist Plotkin referred to this as the “un-certain futures problem.” An organism’s chance of survival and reproduction would be improved if it could somehow solve the uncertain futures problem by changing its behavior to adapt to changes in the environment. The cortex (top layer’ of the brain) is the place where a representation of the world is created. That allows the brain to use the representation of an object or a situation (as a thought) rather than the object or the situation itself and process the information in a remote/detached fashion. Thus our thoughts constantly ‘model’ the physical environment that we live in and signal necessary actions to the muscles and glands to protect our body. Our brains sense and construct models of the environment can be proved by simple experimentation. When people are asked to picture an object in their mind and then rotate it mentally using their hands, their brains act as if the object were actually being turned in front of them with their hands as established by fMRI studies. This proves once again that thinking about an action and actually doing the action are about the same as far as brain is concerned!

Continued stressful thoughts in the brain or a feeling of utter desperation or even anticipation of a distress condition can bring about permanent damage to the body. Extreme stress produces cortisol, which kills brain cells. A recent study at the University of Wisconsin showed that the negative and depressing thoughts activate the right prefrontal cortex of the brain and reduce the levels of antibodies produced. Positive happy thoughts generate activity in the left prefrontal cortex and produce higher levels of antibodies, which help the body in its resistance to infection. Thus the type of thought we entertain has an enormous influence on our body health. Dr. Peter Elias and his colleagues at the University of California have in late 2007 demonstrated a link in mice between psychological stress and increased susceptibility to skin infections.

As remarked by Prof. Cziko in *The Things We Do* (2000), three major principles of overproduction, variation, and selection play an essential role in Darwinian evolution. The same principles operate with respect to thoughts too. Overproduction is evident in the production of thoughts as a constant chatter in the brain; variation is achieved by the random recombination and mutation of several thoughts; and selection occurs as only those thoughts that ensure survival. The thoughts useful for survival are retained as knowledge in our memory and passed onto the offspring in evolution.

Dr. Kornhuber and Dr. Libet found in the seventies that an area in the brain primes an action from a second to three-fourths of a second

prior to your conscious decision of taking that action. If you wiggle a finger, your conscious intention of moving the finger coincides almost exactly with the wiggle of the finger. But the brain scan shows a kick start almost a second ahead of your conscious intention. Dr. Haynes and other scientists in Germany showed in April 2008 that brain activity predicted even up to 10 seconds ahead of time how a person was going to act. "Our study shows that decisions are unconsciously prepared much longer ahead than previously thought. But we do not know yet where the final decision is made. We need to investigate whether a decision prepared by these brain areas can still be reversed." Such questions open a Pandora's Box regarding the existence of 'free will' and who is it that actually thinks in us. This led some scientists to ask enigmatically, "Do we think or Are we thought?"

Prof. Richard Dawkins coined the term "memes" in 1976 as those thoughts/concepts that persist and perpetuate selfishly in their own interest like genes. The whole human culture can be an example for a vast evolutionary process based on memes. Dr. Susan Blackmore in her book ***The Meme Machines*** (1999) talks of the human beings as machines that store, copy and recombine the memes. She holds that what we consider as our "self" is nothing more than memes invading our brains. In her book, ***Consciousness*** (2004), she writes, "Selves are biological products just as spiders' webs are. Like spiders, 'self' doesn't have to know what it is doing; it just does it."

If thoughts have power as demonstrated in the examples given above, and if they can perpetuate themselves invading our brains and create an illusory 'self' within us as a complex of 'memes', can the world we see be real? Could it not be a mere illusion created by thoughts as our sages expressed it?

## 8. PURE MIND

The world is not really what it appears to be. Our mind deceives us into believing what we *think* we see to be what we see. These are not some highly esoteric words of Vedanta. In fact, you do not need any philosophic wisdom to realize the illusion we live in.

The sensory perceptions we receive are given a meaning by our mind, which is a function of our brain. Our brain itself has evolved over millennia of years and in the process learnt innumerable survival techniques - tricks and short cuts for self-protection. In addition, social structure, language, culture etc. too contributed their own algorithms in giving a meaning to what we see. Thus our mind is highly stained and no more pristine. We notice everything through colored filters. Psychologists describe many of our beliefs and attitudes as such filters through which we view the world. Remove the filters which act as our crutches and we fail to recognize even something that we are very familiar with. For example see Fig.1. You know it. But, it is presented from an altered perspective. What is it? An animal? Keep looking at it for a few minutes. If still not clear, read on.



Fig. 1.

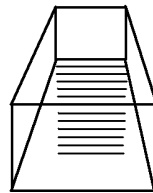


Fig. 2.

Vision is the most important human sense. Does our eye show us reality? Look at Fig.2. Are all the horizontal lines of the same length? Or look at Fig.3. Which two divisions are longer? We judge wrongly because our eye is accustomed to make short cuts to perceive size. Take Fig. 4. Are there really any spots? There are light detecting cells in our eyes. The communication delays between these cells results in the shifting spots.

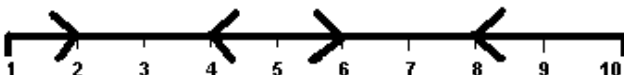


Fig. 3



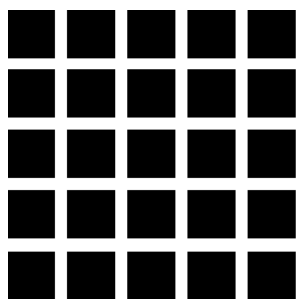


Fig. 4.

As a survival mechanism, brain often supplies missing information and we feel we are seeing the whole truth. See Fig.5. Is there a triangle really between the three packmen? Another good example of how the brain fills in missing information is when you see a placard like this: TO ?ET. If you find it in a window while walking on the road, you give one meaning. Suppose you find it on a closed door in a corridor, especially when you are under pressure to go, you supply a missing letter 'l' in between TO and LET and provide a different meaning. That's how we take advantage of the background.

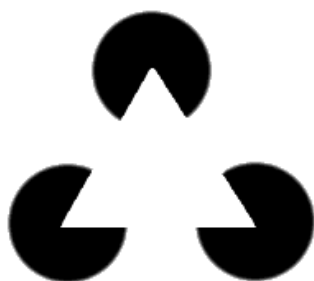


Fig. 5.

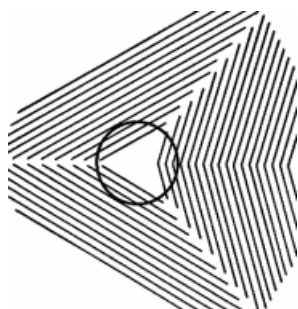


Fig. 6.

But our brain may confuse too projecting the influence of the background onto the object or making faulty comparisons. Look at Fig.6. Is the circle in the center really distorted? Or notice the effect of offsets on the parallel lines in Fig.7. Our vision cannot tell us if something is concave or convex. Take Fig.8. Is it concave? Continue looking. At some point, it appears convex. What is the truth? Can you see it as both concave and convex at the same time?

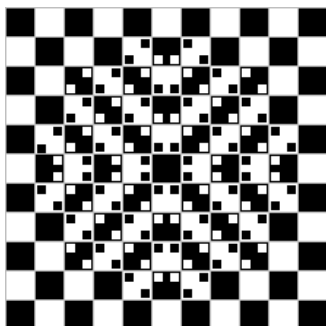


Fig. 7.

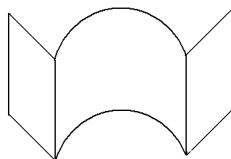


Fig.8.

(After Steve Hagen)

Our brain imagines things depending on what we are familiar with. See the Fig.9. What do you see? A vase? Two faces? I say, neither. They are just two zigzag squiggles! And see Fig.10. Meaningless lines? No. It is a bent woman washing clothes with a bucket nearby. After I tell you this, the figure never again appears as meaningless lines to you. You can never again see the figure with the same innocence you did for the first time, once you learnt what the lines represent! If you have not yet figured out what it is, look again at Fig. 1. Could you get it? Anyway, read on.

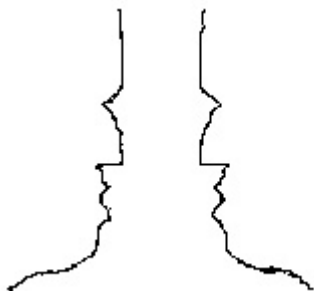


Fig. 9



Fig. 10

Your language, your culture, the way you are brought up, educated and trained will all influence your understanding of what you perceive. Look at Fig.11. Out of the three pictures, a, b and c which two pictures are more related to one another? Most of us will say 'a and c'. Reason? Both appear ready to kick the football. But some native

Indonesians will answer as 'a and b'. Their reason? When a ball is kicked it has to reach the goal. Psychologists say this difference shows the influence of language on the way one thinks. We differentiate events temporally because our language is based on tense. The Indonesian natives comprehend based on spatial relations, as Boroditsky reported in 2001, though all scientists do not agree with this interpretation. The influence of culture becomes apparent when you look at Fig.12. Most of the analytically oriented western educated people will focus their sight on the central point - like the building – whereas orientalists will notice the background trees and beauty, as established by Prof. R. Nisbett. He observed, "East Asians are inclined to be holistic in their reasoning and perception. They focus more broadly on the field in which central objects are located, they attend to relationships and similarities among elements in the field, they are less concerned with categories and rules, and they rely on dialectical reasoning."

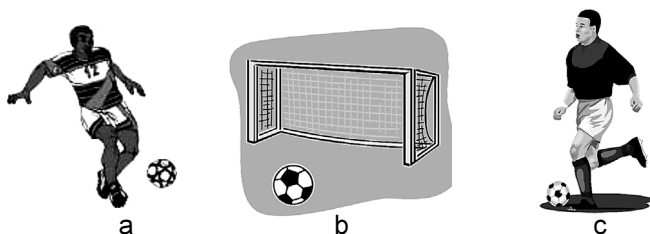


Fig. 11.



Fig. 12.

The impact of cultural upbringing reflects on one's understanding of facial expressions and consequent interpretation of icons. The "Japanese people tend to look to the eyes for emotional cues, whereas

Americans tend to look to the mouth.” The emoticons used in e-mail communications like ☺ for happiness and ☹ for sadness commonly used in the U.S.A. do not mean much to the Japanese. They would rather prefer (^\_^) for happiness and (;\_;) for sadness according to the research work done by Dr. Masaki Yuki, a behavioral scientist at Hokkaido University, Japan.

Dr Roberto Caldara reported in Aug 2008: “In a series of eye-movement studies, we showed that social experience has an impact on how people look at faces. Specifically we noticed a striking difference in eye movements in Westerners and East Asian observers. We found that Westerners tend to look at specific features on an individual’s face such as the eyes and mouth whereas East Asian observers tend to focus on the nose or the centre of the face which allows a more general view of all the features. One possible cause of this could be that direct or excessive eye contact may be considered rude in East Asian cultures.”

Having two eyes is definitely advantageous as it provides a depth to our vision and dimensionality. But this comes with a certain price. It can cause apparitions. Let us do an experiment to prove this. Hold your hands in front of you touching the tips of the index fingers, with the other fingers closed. Look past your fingers as if you are looking at something beyond. Now, slowly pull your fingers apart. Do you see a dangling oval piece of both fingers floating in between? You see this ghost because each eye has its own field of view.

The logic we use in comprehending things is also arbitrary and nothing absolute. We take it for granted many times and do not question. See the following sentences, all of which are fully correct grammatically and convey a meaning. But read together, they are meaningless.

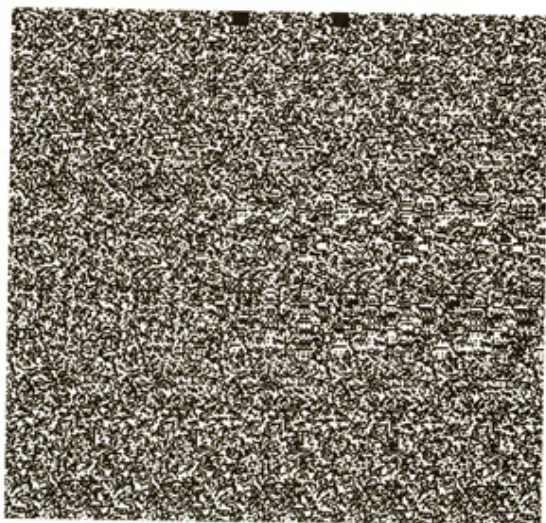
All fish die.

Gandhi is dead.

So Gandhi was a fish.

Or take the arithmetic we use every day. We can divide all things into parts. What is it when you divide nothing by nothing? Or the square root of a negative number? We supply an arbitrary convention as answer.

As the Buddhist Monk, Steve Hagen says in his book, "Buddhism is Not What You Think", (2003), "We all have conceptual habits such as these that help us make sense of the world. But these habits also limit us; they can throw us off, as they do with optical illusions. The habit of framing and encapsulating and viewing things in certain ways is conceptualizing. Thus, it is not just seeing but is rather, in sharp contrast to it.... The awakened see Reality as it is. They see that enlightenment is nothing more than not being deceived by the conceptual world each of us creates." To get a feeling for how this works, look at Fig.13.



(Reproduced with the kind permission of Mr. Steve Hagen)

"Hold the figure about twelve inches from your face. Stare at the two dots at the top of the figure, and unfocus your eyes i.e. see as if you are looking at something behind the paper. Move the figure slightly until a third dot appears between the two. At this point, keep staring, but very slightly shift your vision downward until a three-dimensional image suddenly forms. This image cannot be seen through our common way of approaching things, yet it leaps from the page the moment we know how to look for it." You suddenly realize what it is. Notice your feeling, as you perceive the reality. How lightened and relieved you feel. The earlier unease when you did not understand is

gone now. The heart is lightened and you feel fulfilled. You smile at yourself. (Solutions for Fig.1 and Fig.13 are given at the end).

One needs a totally PURE mind without any cultural, linguistic, evolutionary stains to be able to see Reality with a capital R. Vyasa tells us “That in which all beings wake, is night to Self-seeing Muni (Bhagavad-Gita II, 69).” What a Muni sees with his unstained Pure Mind is invisible (dark) to us. What we see is not seen by the Muni.

**Solutions:**

Figure 1: Picture of Southern tip of India with part of Sri Lanka.

Figure 13: You will be able to get a 3-D view. The letters “PURE MIND” appear raised with a ring surrounding them.

## 9. THE “SELF” WITHIN US

*“I know myself; but not my Self!  
I know me; but not my “I”!*

*I am conscious of my self  
Only when I am self-conscious.*

XX        XX        XX

*“Look inside to discover the Self”  
That’s all the Guru’s offer of help.  
Vedantins say “I” is a bundle of thought.  
Neuroscientists say “I” is nought.*

*I, me and myself get lost in words galore  
Of Science, Philosophy or Ancient Lore.”*

*(From “The Invisible Self”, by the author at Poetry.com)*

The above poem sums up the dilemma of self. Religion monopolized the word “Self” for centuries, eulogized and lifted it to ethereal heights or painted it with supernatural and supramental meaning. Buttressed by religion, we all believe in “self” to the extent that awareness of having a ‘self’ is regarded as a key element of being human.

We experience a sense of ‘self’ principally from our feeling of :

- Continuity (in time) – I was, I am, I will be; (‘self’ also acts as a continuing thread for my personality.)
- Coherence (in diversity) – I am still the same person in spite of my varied thoughts, memories, experiences etc.
- Embodiment (in ownership) – I have my body.
- Agency (in doership) – **I decide** to do; **I have** free will.

Every one of these aspects can, however, get disturbed either in case of damage to some part of brain or under controlled laboratory

experiments. For example if right parietal cortex is tickled with an electrode, the person loses any sense of orientation and feels that he/she is floating near the ceiling watching his/her own body lying below! The person says "I have an out-of-the-body experience."

Decades ago Prof. Libet showed that when we wiggled a finger, an electric pulse was generated not only in the motor cortex but also in the pre-frontal cortex of the brain. This (pre-frontal) pulse occurred as much as three-fourths of a second earlier than our 'conscious' feel of deciding a movement like wiggling the finger. This means that "there's an initial area which prepares us to move the finger. Then the motor cortex executes the motor programs to make you wiggle the finger". German scientists showed in 2008 that the preparedness of the brain for an action could take place by as much as seven seconds in advance. Yet our consciousness of decision-making ('self') coincides with the activity in the motor cortex. Under these circumstances can we claim that our self has "Doership"?

Our awareness of self sometimes gets switched off completely. It happens, for example, when the brain needs to concentrate hard on a tricky task, as found out by Dr. Goldberg and colleagues from the Weizmann Institute. "If there is a sudden danger, such as the appearance of a snake, it is not helpful to stand around wondering how one feels about the situation," Goldberg points out. The brain's ability to "switch off" the self may have evolved as a protective mechanism, he suggests. There are also some neurological cases when a person feels he has no self and believes he is dead. Or weirdly he may consider himself immortal and attempt to kill himself! This condition is known as Cotard's syndrome. Does 'self' exist for one suffering from Cotard's syndrome or for us when its awareness gets switched off?

Very recent studies using various advanced scanning techniques helped identify certain parts of the brain that give us a sense of "self." These are the Medial Prefrontal Cortex (part of brain directly behind the eyes), Precuneus (located near top of the head) and Anterior Insula (located near about the ear). These areas may bind together all perceptions and memories that produce a sense of self in us. There may not be a single spot representing 'self' in our brain.

Some neuroscientists found that our right brain lights up more when we think of others and the left brain gets more active when we



think of ourselves. However, we cannot with certainty say whether our brain processes information about ourselves differently from the way it processes information about others.

“Self” gives a distinct identity for oneself. According to Dr. Heatherton, a sense of self could have developed as an evolutionary mechanism for self-preservation to enable us to read the minds (intentions) of others. Dr. Lieberman finds that human beings are unique in having a well developed Medial Prefrontal Cortex with ‘spindle shaped neurons’ unlike other primates (apes etc). These neurons appear to have a role in processing ‘self-specific’ information. As the child grows to be an adult, another region of the brain that develops is precuneus responsible for autobiographical memories.

Having a self undoubtedly helps in self-protection. But too much of ‘indulgence in maintaining and enhancing a favorable view of one’s own ‘self’ becomes Egotism. Recent experimental study jointly conducted at Carnegie Mellon and Florida State Universities showed that “egotism when threatened makes people particularly more prone to be entrapped in losing endeavors.” No wonder Hindu philosophy exhorts people to dissolve ego to have peaceful life!

Neuroscientific studies on self are undoubtedly in a nascent stage. If I ask you to show a house, you may readily point to a building. But if I strip apart the window, door, floor, roof and the wall, and ask you if any of these is the house, you will say that none of them are the house. Then where is the house? It is merely in your concept. House is a conceptual name for an assemblage of various components like the window etc. As neuroscience progresses, Self could be found out to be no more than a lumped up term (like house) for various mental processes. When once these processes are understood, we may realize that there is no unique individualized “self” within each of us (shades of Advaita!). Or it’s possible that future discoveries may give an entirely new meaning to “SELF”. Once we understand self, we may hope to have treatment for the dreaded disorders like Alzheimer’s, schizophrenia, and Cotard’s syndrome.

## 10. REALITY “OUT THERE” AND QUANTUM PHYSICS

Hello!

*“Hello!”*

Is Dr. Singh there?

*“Sure, he is.”*

Is he not in London?

*“Certainly not.”*

Not in Mumbai either?

*“No! He is definitely here in Delhi.”*

Is he sleeping?

*“What!? Sleeping? No, he is in his office and very much awake.”*

Dr. Singh’s Assistant, though a bit bewildered, sounded very confident in his replies. But I remained unconvinced. If the probability of Dr. Singh being in London is zero and his being present in Delhi is 100%, there must be some probability of his being in Mumbai in-between! Further his Assistant asserts that Dr. Singh is awake. How does he know Singh’s state so definitely without actually seeing him? Don’t think that I lost my wits or I am an over-the-top Vedantin.

Let me explain. Suppose you are lecturing to a roomful of people. How do you describe what the audience is doing? You will say that they are listening to your speech. Can you vouchsafe that every individual in the room without exception is surely listening to you? Honestly, you cannot. Some may be in sync with your lecture. But many others may have been wandering away in thoughts about – the crease in your dress, high tea at the end of the talk or the spat they had with their girl or something. What you can at the best say is that the group is in general listening to you.

So is the case with the trillions and trillions of cells and zillions of atoms and subatomic particles in our bodies. All of them are on constant move. They don’t sit idly at one place. Nobody can for certain say where a particle is at a given time. It can be anywhere in the universe. That’s the weird uncertain world that atomic and subatomic particles live in as Quantum Physics found out from experiments with electrons and particles of light called photons.

Now think of all the particles in Dr. Singh's body. From Quantum Physics angle, they can't all be at one place in his office. Hence his Assistant can only say that there is a high probability of finding Singh in his office, and there is some small probability of his existing in Mumbai, or in London or on Moon or on Andromeda galaxy – all at the same time! This means that Singh exists as if smeared around the entire universe with a denser smear at Delhi. Or alternately his Assistant can say that a longer lasting smear of Singh occurs at Delhi.

If you come this far, let us examine his state. You think that what you observe 'out there' is reality independent of you. You consider yourself as an observer standing aloof having no role in deciding the state of the reality that you see. But it is not true. Let us imagine Singh is miniaturized to one particle instead of considering the zillions of particles in him. Quantum Physics tells that Singh could be both sleeping and awake at the same time. Not merely these two states. He could simultaneously be in a number of many other states. A specific state of his comes into being only if you observe him. You do not know where and in what state Dr. Singh is unless and until you actually see him!

Dr. Schrödinger who was himself responsible in developing Quantum Physics was also puzzled by this counterintuitive prediction. So he thought what's true for particles should be true for cats. Thus evolved the famous thought experiment "Schrödinger's Cat." If a cat is put into a closed box with 50-50 chance of being hit by a poisonous molecule, will it be alive or dead? Well, the answer is that it exists in both states of being dead and alive at the same time. Only at the moment you look at it, it will get into one definite state – dead or alive! All this is not just mental acrobatics and theoretical jugglery. In December 2005, Physicists from Innsbruck did put eight calcium atoms in multiple states. "These atoms were each spinning clockwise and counterclockwise at the same time!" The atoms are lovingly said to be in 'Cat State' by Physicists.

So there is no reality until you perceive it. Reality assumes a firm form and state only after your perception. In other words, you are no more a distant observer but a participant in creating the reality that you notice! Does it imply that the moon does not exist until you look at her? That's a doubt even celebrated scientists expressed! Arthur Koestler famously asked, "Whom does the mirror see when you do not look at it?"

Hence until we consciously observe, “whatever-that-is-there-around” could only be a fuzzy cloud of frantically swirling particles. How does that get reduced to the reality that we see? Quantum Physics has no unique answer for this question. There are a range of explanations. Some question if there is any reality at all. One view invokes Shri Aurobindo’s philosophy. A majority opinion says our consciousness (or measurement) plays a role in reducing the haze into the objects we see. This viewpoint strikes a chord in Vedantins.

Vedas hold that it is not possible to express in any concrete terms “whatever-that-is-there-around.” Its intrinsic qualities cannot be comprehended or expressed by us, because It becomes ‘the world’ the moment we are conscious of It. Vedas named It as “Brahman.” They attempt to convey a sense of Brahman by pointing out to three tentative qualities — Creation, Sustenance and Dissolution — which Brahman assumes when we observe It. Taittiriyaopanishad declares that the world emerges from, is sustained by and absorbed into Brahman. Hence we may say ‘perception’ (because of which the world arises — otherwise, there is no world) activates the tentative attributes of Brahman. In the absence of sensorial perception, It stays as “whatever-that-is-there-around.” Sankara expressed this elegantly and in simple words: “‘Thought’ is the creator of various things” (Aparokshanubhuti, Sloka 14).

## 11. WE ARE ALL AN ENTANGLED WEB

Quantum Physics is the science of small particles. The strange and counter-intuitive phenomena it predicts often leave us stunned. It says that if two particles were together once, they never lose their connectedness even after they get separated. Each particle readjusts itself in response to any change in state of its counterpart which might be several millions of miles away. The readjustment is instantaneous and happens without any sort of messaging link between them. So if you met Dr. Singh once, you can never escape from getting affected by what happens to him, even if you run away to another galaxy!

Unconvincing? Do not blame yourself. Even Dr. Albert Einstein could not digest this sort of “spooky action at a distance” taking place. He, therefore, felt that Quantum Physics was an incomplete theory. He along with a couple of colleagues designed a thought experiment in 1935 to mock at the possibility of one particle being affected by a far away counterpart. It became famous as the “EPR Paradox.” It took 47 years to develop the paradox into a verifiable theorem and then conduct an actual experiment to test it. To everybody’s surprise, the test confirmed what Quantum Physics predicted. The idea that physically separated objects are really separate – got demolished!

From Einstein’s theory one can deduce that the entire universe was no more than a small point about 13.7 billion years ago. Everything was together in that single point. All the forces, chemical elements, stars and galaxies and you and me evolved from that point. Once together always together, says Quantum Physics. Therefore, all of us who evolved from that point continue to be interconnected affecting each other in unknown ways. There is no dodging the entangled web that we are.

Psychic abilities like remote viewing, premonition, clairvoyance etc. appear extra-ordinary. But they are “no longer rare human talents, divine gifts, or ‘powers’ that magically transcend ordinary physical boundaries. Instead, psi becomes an unavoidable consequence of living in an interconnected, entangled physical reality” holds Dr. Radin.

Quantum Physics gives us a clue to materialize things instantaneously over long distances. It is called ‘teleportation’ in physics. Suppose we measure a quantum property of a particle. Our

measurement affects immediately its counterpart entangled particle at a distance. Say I manipulate a few particles to be arranged in the shape of a particular object here. Because what we do to one particle here instantaneously affects its entangled particles somewhere else, it amounts to transferring information from where we are to that distant place instantaneously. So the manipulations done by me here in creating an object will be instantly transferred and exactly similar object gets created at the far off place. This is not a hypothetical argument. Physicists did successfully teleport quantum states for the first time in 1998. So far Quantum teleportation had been done between similar objects, say from light to light or one atom to another. But Dr. Polzik and colleagues in Denmark could “entangle photons with cesium atoms, transmit the light and then teleport properties of the photons on to equivalent properties in the cesium atoms” by a distance of half a meter in 2006. A team of German, Chinese and Austrian scientists teleported quantum bit information across a distance of seven meters in early 2008. These may not sound great to us, but they are very significant achievements from a scientific angle towards teleporting larger objects.

Every particle being entangled with every other particle implies that each particle possesses full knowledge of all other particles. Expressed differently, it means that every point in the universe contains information about the whole universe. We find this incredible feature to be the characteristic of holograms. (You might have seen a hologram in the stickers that some manufacturers attach to their products.) “Any piece of a hologram, if illuminated with coherent light, provides an image of the entire hologram. The information of the whole is contained in each part.” Hence if you break a hologram, each piece still shows the total picture. A hologram becomes smaller “Wholes” and not smaller parts on breakage. Because of this reason, some physicists describe the universe as ‘holographic.’ The total is never lost by losing any parts!

Instantaneous transfer of secretly coded information exploiting the property of entanglement is being developed for facilitating financial and bank transactions over large distances across the globe. Recently USA and Japan collaborated in transferring encrypted information over telephone lines for a distance of 200 kilometers.

We can draw two conclusions from what we understand from Quantum Physics learnt thus far. One is that every particle is interconnected to every other particle. Second is that each particle

exists as if it is smeared everywhere without a definite position unless it is observed. In other words, in an unobserved universe (i.e. in the absence of sensory perception), each particle is everywhere in the universe and is interconnected with every other. One way to understand this is to conceive of them all to be only 'one' and not many different particles. Expressed in cryptic Upanishad terminology, "it is ONE; there is no second."

We have talked thus far about every point in space. Einstein's Relativity theory says that time and space are not independent and absolute dimensions. The universe constitutes a four dimensional spacetime fabric. Extending the logic of interconnectivity of particles in three-dimensional space to four-dimensional spacetime, we can expect every point on different timelines to contain information of all points of all timelines. In other words, each point contains the whole universe of (our) past, present and future. This is completely incomprehensible from our day to day perspective and leads us to an astounding situation of entire past, present, future universe being at one point. If everything of everywhere and of all time periods exists at each point, it is tantamount to nothing being anywhere. Then what and where is creation? We are reminded of what Gaudapada declared: "The highest Truth is nothing is ever created" (Gaudapada Karika on Mandukya Upanishad, III, 48).

## 12. THE WEIRD WORLD OF SMALL THINGS

You are certain about the toothbrush being in the bathroom when you walk in there after a night's sleep. You can definitely tell the time it takes to reach your office. That is all true. But the particles that constitute you or your toothbrush are not as predictable! Quantum Physics studies how tiny particles like electrons, protons, atoms that constitute everything behave. Quantum Physics sobers us down quite a bit. It teaches us not to be so definite and deterministic. It comes out with mind-bending mathematics and concepts almost bordering Vedanta. Dr. Bohr, a giant among Quantum Physicists, famously said: "Anyone who is not shocked by quantum theory has not understood it".

For all that, Quantum Physics is not an esoteric theory. It is derived from actual experiments. Dr. Evans writes:

"If we shoot a beam of electrons at a sheet of metal with a slit in it, a small number of electrons will pass through. The electrons that pass through form what looks like a shotgun blast pattern on a photographic film. If we repeat this experiment with two slits instead of one, we expect to see two shotgun blast patterns. Instead we find bands of alternating high and low hits of electrons. Such a pattern of alternating bands is called "Interference Pattern." It is the characteristic pattern produced when two waves interact like ripples in a water pond when you pelt two stones. The electrons, which behaved as particles when passed through one slit behave as waves when they pass through two slits!

"It gets even more interesting when we slow down the rate of electrons until only one electron at a time passes through the slits. In this case we expect that there would be no interference pattern because there is no second electron when one was passing through the slits. Surprisingly, the electron behaves as if it is going through both slits and interacting with itself to form an interference pattern! It behaves as if it is a wave and also a particle at the same time! More confounding is the fact that this result is obtained only if we look at the photographic film where the electron ends up. But if we look to see which slit it passes through, then it only passes through the slit that we observe it in and does not produce any interference pattern!" If we do not check the path while an electron transverses from one point to another, it appears as



though it has followed several or many paths to reach its destination raising the possibility that the particle was present in multiple locations all at once during its transit.

These findings led physicists to develop wave theory of matter. "In this new view of the world, objects are represented by waves that extend throughout space, containing all possible outcomes of an observation - here, there, up or down, dead or alive." Dr. Schrödinger came up with the math that correctly predicts the chances of finding that particle at any given point. Once you look at the particle, the 'wave' collapses into the single point at which the particle really is. Another peculiar character of particles is: we may know how fast one is moving but not where it exactly is; alternately we may know its correct position but not accurately its speed. This is called as Heisenberg's Uncertainty Principle and puts a limit to what we can know. He cautioned us regarding the fallibility of our set concepts: *"The idea of an objective real world, whose smallest parts exist objectively in the same sense as stones or trees exist independently of whether we observe them, is impossible."*

But then how is it that we still see objects? When do the particles in my toothbrush get the good behavior of staying as my toothbrush instead of running hither and thither? Quantum Physics has no explanation. Nevertheless, it revolutionized Physics in the twentieth century. It helped in the discovery of atomic energy, computers, lasers, satellite communication and so on. It gave the equations to calculate the outcome from an experiment. "Everyone agrees on how to use the equations of quantum theory to make accurate predictions. But there is no consensus on what it really means to have probability waves, nor on how a particle "chooses" which of its many possible futures to follow" says Prof. Greene.

However, there are several conjectures varying from spiritual to philosophical to mathematical, many of them unfalsifiable, to explain why is it that we see objects instead of fuzzy waves. Niels Bohr and a majority attribute it to our perception much akin to Advaita philosophy. Supporters of this view state that the neuronal processes in our brain obey quantum laws. Proponents of Many Worlds hypothesize that the universe splits every fraction of a second into several equally real universes each representing a different possible condition. "Billions of you are splitting off every fraction of a second into discrete universes.

A 500-year-old you exists in some universes, whereas in others you died at birth” says Dr. Higgo explaining the implication of this theory. A variation of this concept gets support from believers in mythologies. For, Puranas refer to “an infinite number of universes each with its own gods, inhabitants and planets.” Dr. Bohm theorized that every particle is guided by a hidden wavefront bringing about an implicit order. Other suggestions keep emerging every now and then.

Some scientists think that the basic equations of Quantum Physics need to be modified to bridge the gap between the weird world of small particles and our day to day reality. Two Nobel winning Physicists, Dr. Leggett and Dr. Ramsey debated recently this question. Dr. Leggett said “Yes” to the question whether Quantum theory needed some tweaking. Dr. Ramsey said “No.” Austrian Physicist, Dr. Zeilinger said it all: “The (actual) world is even weirder than what quantum physics tells us.” Dr. Einstein would certainly agree with this conclusion.

## 13. INVISIBLE ENERGY IN EMPTY SPACE

Universe is overwhelmingly empty. Up in the heavens, Galaxies are interspersed by huge empty spaces. Matter constitutes less than one percent of the universe — about one atom in ten cubic meters of space. Within an atom too there is more empty space than substance. If an atom is magnified to the size of a football stadium, matter (nucleus) in it will be no bigger than a golf ball, the remaining space being just emptiness. However, many ancient Indian scriptures hold that there is energy aplenty in space. Physicists unhesitatingly agree. Evidence for energy in empty space comes both from Cosmology that deals with astronomical objects and Quantum Physics which studies subatomic particles.

Dr. Einstein postulated way back in 1917 the existence of energy in empty space. He said that energy in space counter balanced the effect of gravity and provided stability to universe. He called it “Cosmological Constant.” However, he withdrew later his postulation as a mistake when Astronomers found that the universe was not actually stable but expanding. The words of a seer like Einstein, even if said for a flawed reason, can hardly go wrong. For, Dr. A. Reiss and others found in 1998 that the universe was not only expanding, but expanding with an increasing pace. Astronomers then reverted to Cosmological Constant with doubled conviction invoking it as the cause for accelerated expansion of the universe. Further, Satellite studies in 2006 established that about 74 percent of the universe consisted of some invisible energy. A comprehensive study in 2007 by Dr. Jesper Sollerman and Dr. Tamara Davis of Copenhagen University convincingly established that Einstein’s Cosmological Constant is this invisible energy. Quantum Physics provides the *raison d’être* for the existence of energy in empty space.

According to Quantum Physics, there is always some probability of a subatomic particle appearing anywhere in the universe. But we can never know exactly for sure whether a particle is at a given place or not. It means that particles can keep popping up and vanishing anywhere all the time. Expressed crudely, matter gets created and annihilated everywhere perpetually, particularly when we consider unimaginably small dimensions of time and space (called Planck scales). Therefore, so called empty space would be actually seething

with constant appearance and disappearance of particles at Planck scales. As Dr. J.A. Wheeler said, "Empty space is not empty. It is the seat of the most violent physics." The violent fluctuations of pull-push give rise to energy to empty space. All this analysis is not idle speculation. In 1948 the amount of force that could possibly exist between two parallel plates due to such constant turmoil of particles was predicted. Fifty years later, technology necessary to verify the prediction in the lab became available. Laboratory results confirmed the predicted value. The force is termed Casimir force (nothing to do with Kashmir but named after the original Dutch discoverer).

But can particles cross over huge amounts of solid matter to appear in empty space in the universe? Yes, says Quantum Physics. Small particles "can disappear at one point in space-time and instantly reappear elsewhere even passing through obstructions. This very unconventional and logic-boggling behavior is called Tunnel Effect." Again it is not a fanciful mathematical probability. Real instruments like Scanning Tunneling Microscopes (STMs) are designed based on Tunneling Effect! STMs are extensively used to magnify materials to observe atoms in them. Thus quantum studies indicate that there can never be a true empty space and quantum fluctuations do impart a measurable force to space.

Precision in measurement is the pride of Physics professionals. So they went out measuring the energy in empty space. The measurements by Cosmologists and Quantum Physicists differed by several orders of magnitude. It is like one calling a thing to be of the size of a grain of sand while the other says it is as big as the Himalayas! An obvious embarrassment to Physicists. Prof. L. Krauss thinks it may take several decades to sort out the discrepancy.

Bhagavad-Gita (Ch 8; Verse 9) describes Brahman (Sanskrit root: *brih* to expand) to be smaller than the smallest, yet forms the substratum for all. Brahman is everywhere including us. These characteristics of being everywhere and constantly expanding have an astounding resemblance to empty space energy. How is it then we do not feel this energy? Well, because we can sense things only in contrast to something else. You cannot see a white thing in white light. You cannot view the ocean if you yourself happen to be a drop of water within it. Yourself being the very same energy that is around, you are unable to perceive it.



Astrophysicist Prof. Haisch and colleagues established through their seminal work that matter obtains solidity (mass) because of resistance to movement from the invisible energy in space. That means solidity for matter is not intrinsic; it is an illusion. The illusory nature of matter becomes evident if we could ride a beam of light as observers. If we move at the speed of light, he points out, "All of space would shrink to a point, and all of time would collapse to an instant, because for a beam of light transmission from its point of origin to any point is instantaneous." You will encounter no obstruction, no resistance, no solidity, no substance, no matter at that velocity! It's just one whole without gap. From our perspective, light from Sun takes 8.5 seconds to reach us. For photon itself, the moment it originated in Sun, it is with us. There is no separating distance between Sun and us; it's all Oneness only. Is that Oneness "Realization"? Was it something like a ride on a light beam for those who realized Supreme Truth? Dr. Einstein himself said that he arrived at the groundbreaking Theory of Relativity by his imaginary ride over a light beam!

## 14. COMFORT, HAPPINESS AND ENERGY DYNAMICS

All of us want to be comfortable and happy both physically and mentally. We build machines and gadgets to enhance our comfort or invent clever shortcuts to attain happiness. We designed an elaborate barter system having money at its center in search of happiness. Consequently money became a surrogate for our comfort and happiness. Acquisition of money by hook or crook has in turn become the prime goal for many seeking comfort. But what is comfort?

Anything we do requires energy - whether it is eating, walking, sleeping or talking, we spend energy. Our metabolism tells us how much energy we need daily. We derive our energy needs from the food we eat. Undoubtedly, we have to spend some energy even to obtain food from the environment. And that itself could be stressful many a time as there is no free lunch available.

All of us want a stress-free life. Any stress on the body disturbs its natural disposition and makes us uncomfortable because our body will then be forced to spend extra energy on some "processes like tissue growth and repair, chemical, osmotic, electrical, and mechanical internal work or external work that is necessary" to compensate, counter or adjust to that stress. The following illustration makes the point clear.

I feel comfortable in an air-conditioned carpeted room rather than standing in scorching sunlight because my body has to spend very little of its own energy in maintaining its temperature, fluid and electrolyte balance, etc. in an air-conditioned room unlike in the hot sun. I am comfortable for the same reason, if somebody else does my job, does the worrying for me, (for example if I have a chauffeur-driven car rather than having to face the tension of driving through heavy disorderly traffic looking for street signs). Thus, expending less of our own energy gives us "comfort"!

Prof. Leonard, an authority in Anthropology, agrees with the above observation. In fact, he measured the energy requirements of people living in traditional settings and those living in urban parts of the industrialized world. He found from his studies that individuals living in "non-climate-controlled" conditions (e.g. Siberia, coastal Ecuador), expended about 15-20 percent more calories than people living in "temperature-controlled environments."

Comfort can, therefore, be viewed as an indicator of body's energy audit. The word 'comfort' is generally used for physical ease and 'happiness' for mental state. But "comfort" as defined here, in terms of energy expended, is comprehensive and extends to both physical and mental dimensions and so includes happiness. Intelligence too can be understood better on this basis. In terms of energy, intelligence can be defined as the ability to solve a problem expending the least amount of energy. The person who uses less energy is more intelligent, all other conditions being the same.

Throughout human evolutionary history, man's effort to maximize the energy obtained as compared to energy expended so that he/she would have a positive energy balance has been very much in evidence. Our ancestors, *Australopithecus*, started walking on two feet nearly four million years ago just to save energy on movement (locomotion). "Bipedal movement is more economical than quadrupedal locomotion at walking rates", as was found out by researchers. Further, bipedalism left the hands free as a bonus. The free hands were then available for developing more energy-saving innovations like use of spears and stone tools for gathering food and taking care of children. Our ancestors, using their large brains and intelligence, could reduce the time required for adapting themselves "to a wide variety of novel circumstances" during migrations to new terrains. On its own, evolution through natural selection would have taken many more generations to bring about the same changes in our bodies to make them fit to survive in fast changing environments, writes Dr Price.

Man has also been constantly inventing many tactics for increasing the energy-value of food he consumes while trying to reduce overall input costs. "Cooking augmented the energy available in wild plant foods. With the advent of agriculture, human beings began to manipulate marginal plant species to increase their productivity, digestibility and nutritional content. This kind of tinkering continues to today, with new techniques like genetic modification of crop species, for gaining as much nutritional return from our food in as little volume and with as little physical effort as possible," says Prof. Leonard. According to Prof Leonard, "The energy dynamics between organisms and their environments – that is, energy expended in relation to energy acquired – has important adaptive consequences for survival and reproduction."

From a strictly evolutionary standpoint, the procreation and propagation of a species is facilitated if we can spend less energy on our basic maintenance so that more energy could be allocated for offspring. Our body budgets the available energy resources by apportioning them between maintenance and reproductive activities. Restricting an individual's calorie intake by 30 to 40 percent is known to extend the life span. Drs Sinclair and Gaurente opine, "Calorie restriction is a biological stressor like natural food scarcity that induces a defensive response to boost the organism's chances of survival." Dr Fontana says we should eat less but eat a balanced diet to improve longevity. A recent study by the National Institute of Health, USA confirmed that calorie restriction does help in better health including less oxidative damage to the DNA – perhaps the reason for the elaborate rituals of fasting prescribed in many cultures!

Sun is the ultimate source of energy for all. We worship him as God. But we cannot draw energy directly from him, though we are the most energy-guzzling species. Only a few creatures can directly capture and store sun's radiation. These are called autotrophs. Plants are autotrophs. They developed efficient ways to fix carbon and release oxygen from carbon dioxide in the atmosphere using energy from sun's light and water from ground. They store a portion of this energy as carbohydrates to conduct their own metabolic business. A vast majority of the other creatures depend on the stored energy of the autotrophs for their own energy needs. These are called heterotrophs. Man is a superb example of heterotrophs. Heterotrophs effectively and literally steal the energy processed and stored by the autotrophs.

No wonder, Vyasa asks us to at least express our gratefulness for the food we consume (i.e. the energy we steal); otherwise we are verily thieves, plain and simple (Bhagvad-Gita, Ch III, Sloka 12).



## 15. PREDICTION BY PHONE

The other day, my nephew informed me excitedly about one Mr. Rao, who could foresee the future and give answers to our problems just with a call on the phone. Predictions by a mere phone call?

The fact of the matter is, all of us do that. Yes, all the time! If your spouse has gone to the office or market, you predict the time of her/his return. Even if you are not into buying a house, you can tell the approximate cost of a property in your area. You can advise your relative about the possibility of getting a reservation by a particular train, though you may not have traveled by all the trains leaving your town. From the looks of the signboard, you decide in a new place if you should walk into that hotel for food or not. These may sound trivial. But your mind is working basically on the same principle – an ability to predict an outcome with sparse information. Have you not come across the person who advises on investments – shares worth buying, which derby is good to bet? Did you not hear about the boy who could correctly anticipate questions for the exam, selectively prepare on those questions and pass with the best of grades? Laymen may know it as “gut feeling”; managers give it a fancy name: “Heuristic Approach.”

There is always a discernible pattern in the way things occur in nature. What we call as random also has a definite pattern fitted into a mathematical expression by Gauss! Whether you may win a lottery or not, whether it is head or tail on a throw of a coin and many other incidents in life follow this particular pattern. This is called the “Normal Distribution.”

There are other types of distribution also. “The number of cars that pass through a certain point on a road at rush hour; the number of typing mistakes your secretary makes in a page; the number of phone calls at a centre per minute; the number of road kill found per unit length of road” follow what is called Poisson distribution. The occurrence of wealthy people in India is a skewed distribution. The waiting time before you get a connection in a telephone queue is as per Power-law distribution. With what probability a specific event occurs can be calculated once we know which type of distribution it follows.

We constantly face changing situations and environments. This is called the Problem of Uncertain Futures. Quick decisions have to be taken for survival without the luxury of having wads of data and

information on the probability of occurrence of a given event. So we are forced to guess the outcome though we may not know the exact type of distribution of that event. What we may have at our disposal could at best be one or two pieces of prior instances. Our expectation of the future event has to be based on that limited knowledge. Fortunately, our brain has acquired that uncanny trick through evolution. If we do not put to use such coping mechanisms naturally inherent in us, we tend to lose them through disuse. For example, a newly born kid can swim if dropped into a pool; but not after it has grown up. A domesticated animal cannot fight for food like its counterpart in the wild. The domesticated animal lost many of its natural responses because of the security provided by its keeper.

Thomas Bayes, an eighteenth century priest and mathematician in England studied the predictability of events based on one or two prior bits of information without extensive database. Bayesian technique of prediction was quite popular for sometime. But statisticians pooh-poohed it. They insisted on more data to know how exactly an event occurs before they can predict the next outcome. Hence the marketing people ask for large amount of samples before they make their predictions on the success of a product in the market or on trends of change in population. The present day computer scientists are reviving the idea of Bayes. They want the computer to work like a human brain with limited data.

So psychologists got into the act. We know that our brains are adept at pattern recognition. The psychologists feel that “Bayesian capacity to draw strong inferences from sparse data could be crucial to the way the mind perceives the world, plans actions, comprehends and learns language, reasons from correlation to causation, and even understands the goals and beliefs of other minds.” Dr Griffiths and Dr Tenenbaum tested to see how far our brain does and can make predictions correctly with one or two data points. How successfully can our minds guess “the way the world works – in essence, a hypothesis about reality.”

Participants in their research were asked to estimate the total likely earnings of a film giving them only one piece of information - amount earned in the first few days. They were also asked to guess the total length of term a congressman would serve given how long he had already served; the duration that a cake would take to bake given how long it had already been in the oven and so on. Indeed these are very diverse

matters and follow a variety of distributions. But the participants successfully predicted correctly each time! This gave confidence for computer builders to design machines to take decisions based on sparse amounts of information.

So could it be that Mr. Rao or the successful student guessing the exam paper or the person advising on investments activated that part of their brain which has a knack to predict a result based on one or two bits of information? But how did the human brain acquire this capability in the first place? Is it merely by trial and error through generations of evolution? Or has a super natural power bestowed this capacity to the brain in the beginning? Well, ponder over the questions and your own brain will answer using Bayesian technique based on one or two of its own prior experiences!

## 16. EFFECT OF MEDITATION ON BRAIN

**Meditation does have a profound effect not merely on the way our brain functions, but even on its physical structure!!**

It's a long haul from the era when science held that brain fixed in early childhood did not change to the present view that mental training can lead "to long-lasting changes" and "our brains form a million new connections every second." The Dalai Lama's invited address on "Neuroscience of Meditation" at the 35<sup>th</sup> conference of Society for Neuroscience in Washington epitomized this paradigm shift. It is not that the current research findings are undisputed. It's also not that the disputants are above their own prejudices. But what is indisputable, however, is that neuroscience points to a conclusion, "that would be right at home", in Dr Schwartz's words, "in the canons of some of the Eastern Philosophies."

The US government's declaration of the nineties as "Decade of the Brain" helped kick start research into the uncharted fields of neuroscience. The Dalai Lama actively promoted scientific study of meditation for over a decade. Buddhism, with its dictum that "empirical evidence should triumph over scriptural authority in the investigation of reality, no matter how deeply venerated a scripture may be," was helpful to this thrust. Well respected neuroscientists are now no more averse to grappling issues like "what is self", aided by modern advances in electronics and current developments in neuroscience.

Mahesh Yogi initiated scientific investigation into meditation about forty years ago. His group reported many downstream "benefits" of transcendental meditation. Some of the benefits found by the group are:

- More widely distributed somatosensory stimuli across the cortex.
- Higher mean EEG coherence over all brain areas
- State of deep rest with reduced respiration rate and reduced basal skin conductance.
- Reduced blood pressure and cholesterol levels.
- Younger biological age.

Dr. Benson's team at Harvard medical school studied Sikhs in meditation. Brain areas associated with attention, space-time concepts and executive control functions were more active during meditation. There was increased blood flow in the limbic system and brain stem that control automatic nervous system. Dr. Benson noted that relaxation exercises [akin to meditation] released "increasing amounts of nitric oxide which counters the negative effects of the stress hormone norepinephrine." This results in remarkable calming of body. He also documented an unexplained phenomenon – the capacity of some Buddhist monks in meditation. The monks could dry icy, wet sheets spread on their naked bodies in near freezing temperatures while they were meditating in snowy Himalayan peaks!

Dr Newberg observed that, during peak moments of meditation, neurons in the posterior superior parietal lobe (responsible for spatial orientation) exhibited unusual activity. Work by Dr. Beauregard treating patients of spider phobia demonstrated "systematic changes in prefrontal cortex (behind the eye brows) after cognitive-behavioral therapy." Cognitive behavioral therapy can be described as a sort of meditation.

Psychiatrist Dr. Schwartz designed a protocol that mimics Buddhist meditation techniques of "Mindful Attention" to treat patients of Obsessive Compulsive Disorder. He demonstrated, through progressive brain scans, a change in the metabolism of caudate nucleus and also changes in the circuitry in other parts of brain when his four step therapy was followed by patients. He found that neuronal connections alter under the intentional activity of the mind establishing the plasticity (alterable nature) of brain.

Dr. Davidson found that "long term Buddhist practitioners self-induced sustained gamma-band oscillations (40 Hz) and phase-synchrony (awareness and coordination) during meditation." The data suggested that mental training through meditation could induce short-term and long- term neural changes.

Many research workers established that large areas of brain, particularly in left prefrontal cortex (just behind the left forehead) were active during meditation. This part of brain is responsible for positive emotions. Alpha waves in 8-13 Hz are produced in a meditative brain. A person's peak performance (say in sports) and creative inspiration are associated with bursts of alpha waves. More alpha waves mean less anxiety, better immune system and hence better health.

Dr. J. Austin found that breathing rate slowed from about 12-18 breaths per minute to 4-6 breaths per minute during meditation.

He also said that that “breathing out quiets the activity of brain cells while breathing in increases activity [and] an overall reduction in oxygen consumption which is different from sleep.”

Dr Nathanielsz narrates an interesting story of a stressed-out high-profile lady executive, Mrs. M. She was pregnant with her first child. Every method of relaxation, exercise or even medicines could not relieve her of her constant anxiety about pregnancy and the stress she had to handle at the job. The situation grew so critical that it threatened the health of the fetus and having a safe delivery. Dr Nathanielsz advised her to follow a routine of quietly thinking for fifteen minutes every day about her to-be-born baby and how she wished the child should grow. This is, in fact, a mental exercise akin to meditation, without assigning a name. At the end of the due period, Mrs. M gave birth to a healthy baby in a normal delivery!

Dr Beauregard’s preliminary work in Montreal on Carmelite nuns showed that a network of brain regions including those associated with emotion processing and the spatial representation of self were involved in deep meditative states. Dr. Lazar recently reported her work on Buddhist “Insight meditation.” She found that meditation actually increased the thickness of the cortex in areas involved in attention and sensory processing, such as the prefrontal cortex and right anterior insula. The changes in the brain structure were comparable to what happened in the case of well-practiced and accomplished musicians or athletes. With meditation the brain tissue too thickens just as muscles grow with physical exercise.

Some New Age Gurus mistakenly compare mystical experience with orgasm. Dr Newberg points out that the ecstasies of sex are primarily tactile sensations and involve hypothalamus. Experiences that lead to the intense unitary states in meditation depend upon higher cognitive structures in the prefrontal cortex and the parietal lobe (decision making and spatial orientation parts of the brain).

Dr. Davidson feels that meditation could enhance the brain’s ability to modify maladaptive emotional responses like depression. A neurological term, “Self-directed Neuroplasticity”, describes the principle that focused training can systematically alter brain function in a useful manner. Some scientists hope even to “assisting spiritual transformations of individuals” from neurobiological knowledge. However, the Dalai Lama puts in proper perspective: “The purpose of meditation is not to cure physical ailments, but to free people from emotional suffering.”

[In this article, the word “Meditation” is used in a broad generic sense and does not refer to any specific type or technique of meditation.]

## 17. PAIN, SUFFERING AND PLACEBO

*"It's a miracle. The holy ash given by the Great Baba cured my unbearable pain!"*

*"An affectionate touch and a wave of hand by MataSri; that's all; my asthma is gone!"*

*"The Swami sprinkled holy water; and my colic cramps disappeared!"*

*"The intense gaze of my Guru rid me of my chronic depression!"*

Very often we come across people making such excited statements and strange claims. They make us wonder if they could be true. It was about half a century ago that Dr H. K. Beecher of USA reported the "Placebo Effect", by which a third of the patients got better from a mere illusion of treatment. It has ever since intrigued scientists how a "placebo" - an inert pill not containing any medicine, but for the confidence and suggestion of the doctor can cure patients. A study in 1993 concluded that sometimes the effects of a placebo may go up to 70 per cent. During 1994 in Houston, even faked surgeries on the knee for arthritis relieved the patients from pain. Patients suffering pain after wisdom-tooth extraction got just as much relief from a fake application of ultrasound. Fifty-two percent of the colitis patients treated with placebo showed less inflammation in their intestines. There are a few controversies too regarding some of the placebo studies. Questions on the statistical rigor and possible biases because of the financial and other vested interests of drug firms and health administrators in some of those studies were also raised. However, placebos do seem to work. Drug companies now as a rule test the efficacy of a new drug against a placebo before marketing it.

It is not always known how the placebos work - whether it is the natural waxing and waning of the diseases or unknown remissions or because of the autosuggestion of the patient himself/herself. It also looks that the placebo effect does not interfere with the body's ability to sense pain but instead affects how the brain modulates its interpretation to the pain signals. Modern studies using functional Magnetic Resonance Imaging (fMRI), PET scans of the brain's activity and neurochemistry are throwing new light on the effect of the placebos.

Psychology has a major role in the feeling of pain. Unless the brain pays attention, pain is not felt. A mother so very often diverts her child's attention with a toy or music when the child is crying with pain. There are some very painful procedures that have to be carried out on patients with severe burns. Such patients did not feel pain when their attention was diverted using virtual 3-D games, which the patients played while undergoing the procedures. Dr. H. G. Hoffman who recently carried out the work says, "Human attention is like a spotlight, allowing us to select some information to process and to ignore everything else."

At the University of Michigan an fMRI study was done on the brains of volunteers exposed to painful electric shocks. In some cases the researchers told participants (falsely) that a pain-relieving cream had been applied to their skin. When these subjects were given electric shocks, they reported less pain. Their fMRI pictures exhibited increased brain activity in the prefrontal cortex and decreased activity in pain-sensing regions like thalamus. Dr. V. S. Ramachandran neurologist of California describes the interesting case of a patient who laughs when pricked with a sharp needle. The patient feels the prick. Yet it tickles him rather than hurt. Dr. Ramachandran also described the pain experienced by patients in a phantom limb that's not really there (removed surgically). He could study from such cases the information pathways of nerves that convey the sense of pain from the organ to the brain.

Recent advances in neurochemistry are offering further understanding about pain and pleasure circuits in the brain. Our ancients knew the pleasure inducing chemicals like marijuana, bhang and others. It is now known that our brain produces similar compounds to mitigate pain.

Dr. Mechoulam discovered in 1992 a fatty acid produced in the brain that mimics marijuana. He named it "anandamide" after the Sanskrit word *ananda* meaning "bliss." Later more such chemicals were identified. Work with mice in Germany indicates that such chemicals help in ending bad feelings and pain triggered by memories. There is mounting evidence now that people suffering from depression respond well to a placebo.

Endorphins are chemicals that reduce pain and give us a sense of pleasure. Exercise or some of the foods we eat can produce endorphins in our brain. Scientists from Germany demonstrated in 2008



for the first time “increased release of endorphins in certain areas of the athletes’ brains during a two-hour jogging session. Body’s own opiates are produced in the same areas of the brain which are involved in the suppression of pain.” Feel-good hormones are released during exercise, a good conversation, and many other aspects of life that give humans pleasure. Researchers at Rutgers University reported in June 2008, that the feel-good hormones in our brain do not just make us feel good, but also play roles in regulating the stress response and improving resistance to disease. A survey by Dr Jon Tilburt in 2008 showed that most doctors in the USA prescribed medicines as placebos to their patients.

A recent study using brain scans showed that the prefrontal cortex could inhibit the passage of pain signals. Prefrontal cortex is the area of our higher brain functions. Meditation/relaxation influences its activity. From all these studies, we can conclude that we definitely have in us some keys to control our pain and suffering.

Now we can see some convincing linkages between the above findings and the statements and claims of people mentioned at the beginning of this article. Sure enough, the holy water, the ash, the touch and an assuring word all work for in the amelioration of our vexing chronic pains and problems of suffering possibly as placebos. The word placebo means: “I shall please”. These holy men are able to please and inspire us to help ourselves by producing necessary endorphins naturally within ourselves. As long as they can maintain their humility and not exploit the gullible, the holy men have a social value to that extent. That is ingrained in our Eastern tradition, a part of our rubric. We should remember, however, that the placebos work in general in 30 to 40 per cent of the cases. Serious cases of illness do always require medical care.

## 18. EXPERIENCING OTHER'S PAIN

Sri Ramakrishna Paramahansa had once to look on helplessly when a person was being whipped. Ramakrishna writhed in pain. Marks of the whiplash appeared on his back as though he himself had been beaten. Even today we hear of many such stories when venerable Sadhus experience physically the suffering of their devotees.

Neuroscientist Dr. Blakemore writes about a 41 year old Ms C. "The sight of someone being touched made Ms C feel as if someone were touching her at the same place on her own body." Ms C thought that was how it would be for everybody and never considered such a feeling to be strange! Dr. Blakemore says, "Imaging studies showed that C's touch-sensitive brain regions reacted more strongly to the sight of someone else being touched than those regions did in the normal subjects."

We know how our own pain feels and how Swamis help us in getting some relief (See Essay 17. Pain, Suffering and Placebo). But how is it possible to experience another's pain or touch?

Many of us feel the same emotion as an actor we identify with while watching a movie. As we watch an action in real life or on screen, we enact the same movements in our brain. This is called empathy. Scientists from Israel showed using magnetic resonance imaging (MRI) that the activity in the brains of a group of people watching the same scene in a movie is typically similar. So our brains are affected by what we see.

Dr. A. Lutz and others observed that recent brain imaging studies using functional magnetic resonance imaging (fMRI) implicated insula and anterior cingulate cortices in the empathic response to another's pain. "Specifically", they reported in March 2008, that "concentrating on the loving kindness one feels toward one's family (and expanding that to include strangers) physically affects brain regions that play a role in empathy."

While empathizing, we imitate another person. In fact, this is the way we learn many skills, even language – simply by imitation. So empathy enables us to put ourselves in other person's shoes – to feel and understand a situation from the other person's perspective. Or, in other words, to read the other person's mind and understand his intentions. Empathy has thus a survival value for us. "Empathy lights

up the same parts of the brain” when one watches another person doing a thing or one does it by himself – whether it is just grabbing an object, eating or watching a movie. Dr. Singer of London demonstrated through functional magnetic imaging studies (fMRI) that this phenomenon occurs in case of pain too. She showed that “the similarity of the scans when pain was experienced by a group of ladies when they were themselves subjected to or when they watched others getting an electric shock.”

What happens in the brain when we empathize is being now understood by scientists as the action of Mirror Neurons. All of us have mirror neurons in our brains. These neurons reflect in us like a mirror the same feelings as others have when we watch them. Mirror Neurons cannot explain everything though. Nor the understanding of the way these neurons function is completely free from controversy or without debate amongst the experts. Yet, the mirror neurons appear to open up a path to tease out the mystery involved. Dr. V.S. Ramachandran, Director of California-based Center for Brain and Cognition hailed the discovery of Mirror Neurons as “as significant for psychology as DNA was for Biology.”

Mirror neurons were first noticed in macaque monkeys about a decade ago. A set of neurons in the premotor cortex “fired not only when the monkey performed an action, but also when the monkey saw the same action being performed by someone else – whether it is grasping an object or eating.” This cluster of neurons mirrored even emotions and sensations. In the absence of these neurons, our brain (mind) would have only accumulated information as “lists” without an emotional relation to like the TV serial character, ‘Dr. Spock’. “We share with others not only the way they normally act or subjectively experience emotions and sensations, but also the neural circuits enabling those same actions, emotions and sensations: the mirror neuron systems,” says Dr. Gallese, one of the discoverers of the mirror neurons.

Dr. Ramachandran feels that mirror neurons could have facilitated the occurrence of sudden spurts of growth in human culture. Fortuitous and unique discoveries – like fire, tool-making, language, math, art or other knowledge gained by a primitive human being could get transmitted from one to the other because of the mirror neurons. These neurons provide a virtual reality image in one’s own mind of what goes on in other’s mind. The mirror neurons help in “imitation learning”. So mirror neurons could contribute to the development of a ‘meme pool’.

Recent work at the University at California led the scientists to ascribe autism in children to defective mirror neuron system. “Although the autistic children were able to perform a task, they had lower activation in a brain area containing mirror neurons, both when watching and imitating facial gestures” as compared to controls. Dr. Ramachandran suggests that damaged mirror neurons may also explain ‘anosognosia’ – a denial syndrome wherein the patient of, say, paralysis denies having been paralyzed. A psychopath’s inability to sense the pain of his victims may be due to faulty mirror neurons.

Israeli scientists achieved in 2004 the difficult task of scanning the brains of a group of people watching a movie. The brain-scans showed similar patterns in all the viewers in response to the scene being watched. This could offer clue to understand the phenomenon of ‘mass hysteria’ (*banamati*) experienced by women and youth from rural areas. Each one feels the emotional arousal state of the other as his/her own and enacts the same feeling.

Can the mirror neurons cause the physical appearance of the injury marks by mere first person experience of observing a third person being injured as it was reported to have happened with Sri Ramakrishna? One does not know. But one can hope that the mystery behind such phenomenon may one day become clear.

## 19. SEX AND THE BRAIN

Decades ago Swami Ranganathananda was giving an exposition on “Vivekachudamani” of Adi Sankara. When he came to the very second sloka (verse), he stumbled. It was tougher with the 4<sup>th</sup> and 5<sup>th</sup> slokas. The slokas say that being born a ‘male’ is a rare and special gift. He turned apologetic towards his female audience. He gave a long-winded explanation why Sankara had to say that. Today, if he were to lecture again, he need not! The female brain does differ from that of the male as the research findings of the last few years show. Vivekachudamani is for MEN only!

The saying that “Men are from Mars and Women are from Venus” is well-known. Dr John Gray, who authored the book with this title graphically, illustrated many humorous examples of the differences between male and female thinking. If you ask a simple question, say road directions, the lady may end up telling you how her child missed her way near the “forked tree” while she was once going in that direction whereas you get a straight and to the point answer from her husband. Because of the difference in the size of the hippocampus (bigger in ladies), the females navigate with ‘landmarks’ whereas males do by ‘dead reckoning’ (spatial orientation). If you searched the vanity bag of your wife, you may find a veritable museum of pieces dating back to, God forbid, her high school days - nappies of her child or toffees for grandchildren, a medical chest and a broken lid for repair pending for the last six months. On the other hand, the man may forget where he placed his keys and purse even five minutes ago. Your wife can easily cook while talking on the phone, keeping an eye on the child and answer your question on misplaced socks. You (males) are focused and can concentrate only on the one job on hand – reserving the best seats for the evening show. Research at Cambridge University found that even one-day old male and female babies too differ in their preferences. Girls like dolls and faces; boys prefer mechanistic things!

Dr. Reiss of Stanford University found in 2008 that “video games, particularly territory acquiring and aggressive type activate reward regions in the brain more in men than women.” The concerned brain circuit involves nucleus accumbens, amygdala and orbitofrontal cortex. Earlier he found that men and women process humor too differently. So do not complain if your spouse thinks that your joke was not funny. “Research at the Swedish medical university Karolinska Institute shows

that the brain's serotonin system differs between men and women", says a report in early 2008. Serotonin is a brain neurotransmitter that is critical to the development and treatment of depression and chronic anxiety, conditions that, for reasons still unknown, are much more common in women than in men.

"Two neuroscientists from Georgetown University Medical Center discovered in 2006 that boys and girls tend to use different parts of their brains to process some basic aspects of grammar, suggesting that sex is an important factor in the acquisition and use of language." Psychologists Drs. Agneta Herlitz and Jenny Rehnman in Stockholm, Sweden in 2008 found that "Women were better than men at remembering everyday events."

However, Prof. Larry Cahill says, "To date, no one has uncovered any evidence that anatomical disparities might render women incapable of achieving academic distinction in math, physics or engineering. And the brains of men and women have been shown to be quite clearly similar in many ways. Nevertheless, over the past decade investigators have documented an astonishing array of structural, chemical and functional variations in the brains of males and females." Such variations have significance in disease pathology and treatment. Men and women show distinct symptoms with respect to Alzheimer's and schizophrenia.

Scientists from Harvard University found that "parts of the frontal cortex, the seat of many higher cognitive functions, are bulkier in women than in men, as are parts of the limbic cortex, which is involved in emotional responses. In men, on the other hand, parts of the parietal cortex, which is involved in space perception, are bigger than in women, as is the amygdala, an almond-shaped structure that responds to emotionally arousing information - to anything that gets the heart pumping and the adrenaline flowing."

All human beings are females when first conceived. (No wonder that our ancients placed *Stree rupa* – feminine form – at the head of creation). The fetus in the womb is in feminine form to start with, including the shape of its genitals. Only later differentiation changes the fetus as a male. We, humans have 23 pairs of chromosomes. One of the chromosomes is responsible for sex difference. The female has XX chromosome pair, each X coming from one parent. The male child has XY chromosome pair with the X from the mother and Y from the father.

The Y chromosome from the father by itself does not guarantee that the fetus will be a boy. There are instances of persons with Y chromosome but ending up as a lady. This is because the secretion of testosterone hormone in the womb at the correct time in correct amounts brings out the sex difference, including the change in the genitals. A very recent study from Finland showed that in the case of a girl having a boy as twin, the girl is less likely to produce more children and exhibits more independent behavior. If the twins were both girls, such characteristics were absent. This is supposed to be because of the presence of testosterone hormone in the mother's womb when the twin fetuses were growing, thus establishing once again the influence of testosterone hormone.

Even in handling stress, men and women differ. Research at the Arizona University showed that females can withstand chronic stress better than males, though in the short term, males produce serotonin faster and are less likely to be depressed quickly. Men and women respond to and remember emotional events differently. The right hemisphere amygdala is involved in men (and hence store a holistic picture) whereas the left hemisphere is involved with the women (and hence they have a memory for details). Scientists at the University of Pennsylvania measured the size of the orbitofrontal cortex, a region involved in regulating emotions, and compared it with the size of the amygdala which is responsible for emotional reactions. The investigators found that women possess a significantly larger orbitofrontal to -amygdala ratio than men do. Prof. Cahill speculates from these findings that women might on average prove more capable of controlling their emotional reactions. If you remember that the central teaching of Bhagavad-Gita is emotional control and attainment of a balanced mind, do the ladies need to learn Gita?

Remember the frontal cortex, the seat of higher executive and cognitive functions, is larger in women. They need not have to take lessons from Vivekachudamani (The Crest Jewel of Discrimination) to improve their cognitive functions. They have it by nature!! It is men that need the lessons from Vivekachudamani with an encouraging pat on their back! So Ye, Men, practice meditation, read Vivekachudamani. Remember, Women are already blessed.

## 20. WAKEFUL, SLEEP AND DREAM WORLDS

The last shades of winter are fast fading. The cloudless evening sky is blue with a tinge of crimson at the horizon. A waft of gentle breeze softly caresses the body. Swarms of lights in different neighborhoods spring to life sequentially as if playing in a symphony. The surge in the sea increases. Our stroll at the beach ends. The carrier-boy is ready with hot meals as we return home. We quickly finish the grub and get down to our studies.

That was the routine during our student days. As the final exams approached, we decided to study late into the nights. We made arrangements for tea and a snack at 10 pm. We used to study seriously till 10, slobbering for the hot *mirchi pakora* (deep-fried jalapenos). I would eat my share but could hardly stay awake. Right away I used to sleep off. My friends were more determined. They never slept before they bid good morning. But when the exam results came, I always topped. At that time every body said that I was intelligent. Half a century on, now I realize it's nothing of my greatness. Just this month scientists from Belgium have showed how "getting a good night's sleep after learning something new impacts the way brain stores information" for accurate recall. My friends were clearly under the myth that the more night-outs they did, the more they could cram!

Many myths exist regarding sleep and dreams, which fascinated mankind for long. Spiritualists and religious people read significant messages in them. Vedantins developed their model of '*mithya*' based on them. A century ago Dr. Frued theorized that dreams represented repressed emotions and considered them as a "royal road" to understand the hidden personality. The whole field of psychoanalysis came into being and Psychiatrists quickly adopted it as a diagnostic tool considering dreams to be symptoms of inner personality problems. So considerable attention was given in the past to search for ways and means of deciphering the meaning of dreams. Investigations during the last couple of decades, however, are throwing new light on both sleep and dreams.

Sleep is not unique to humans. All animals, fish, flies and even worms sleep! Several animals have dreams. Fetuses and babies spend 75% of their sleep time in dreaming. Nearly a third of our adult life goes



in dreams! Our eyeballs move rapidly behind the closed eyelids during dreaming. It is called Rapid Eye Movement (REM). However, some dreaming may occur under non-REM conditions. Though we get more than one dream a night, we usually remember the last one before getting up. That also happens to be the longest dream.

When we are awake, we experience the constant chatter in our brain as 'thoughts'. In a sense this chatter is 'dreaming' during REM sleep. Neurons in the brain constantly buzz sending electrical pulses to one another as actively during dreams as when you are awake. This neuronal activity records an electromagnetic field of 40 Hz (cycles per second) on an EEG (Electroencephalogram). If you are relaxed and in a creative mood, EEG shows 8-12 Hz. During deep sleep EEG records 4 Hz or less but not zero. Our brain never rests. Dr. B. He and Prof. M. Raichle reported in October 2008 that a low frequency hum goes on in the brain even during deep sleep. The brain chemistry, however, keeps changing. During wakeful hours, the forebrain (behind eye-brows) sends more "amines" to the cortex; during sleep, the brain stem (the oldest part of brain) sends more "cholines" to the amygdala (center of emotions). It is the delicate balance of these two chemicals along with electrical activity that decides whether we are awake or dreaming.

You absorb consciously through your senses external information at the rate of about 40 stimuli per second. Though you may be unaware, your senses keep collecting much more information from the surroundings. For example, now as you read this, you are conscious of the black letters and the white background and the magazine in your hand. You become aware that you are breathing only when I point out. You find that you are also hearing the hum of the tubelight or noticing the wall of the room when I specifically draw your attention. In fact, the amount of information gathered unconsciously is 20 million stimuli per second. Because the senses are at rest during dreaming, brain does not have this additional info. Brain interprets the existing neuronal activity during dreaming without the benefit of this extra information. Further, the dream and wakeful worlds have their own space-time dynamics, which do not match with one another. Because of the paucity of total information available for the neurons and because of the differences in space-time relations, we see a bizarre world during dreams that does not conform to the wakeful world.

Experiments with animals showed that dreaming helps in the formation of memories. Dreams clean the clutter of the day and sort information. What is to be remembered is organized and stored in different parts of the brain. Dreams serve to rehearse day's events and get us ready to face more easily similar situations later. MIT Scientists found that during dreaming short-term memory is shifted to long-term storage. Emotions too "prune and edit" what is stored as memory. A traumatic experience is better remembered than a routine one like what you had for breakfast last week. A very recent finding shows that what you smell as you go to sleep influences your dreams. Unpleasant smells produce negative emotional dreams. Pleasant smells produce positive emotional dreams.

Dreams sometimes throw up eye-opening doors to a block in our thinking and provide surprising solutions. Understanding the structure of benzene (that revolutionized organic chemistry), Nobel Prize winning discoveries of Rutherford and Loewi were based on answers the respective scientists had found in their dreams. Neurobiologist Dr. Winson feels that such sudden solutions in a dream for vexing problems "may have been the result of memory-processing during sleep and might not be an oddity." In general, in order to understand the content of a dream, one author recommends a good rule of thumb: "Look at the feeling present in the dream and search your daily life, especially the previous day (or six days earlier) for the same feeling. This greatly helps you tie together the dream symbols and their waking counterparts. On the other hand, if the feeling shocks you with a strong component of anger or sexuality, for example, then the dream may be a safe outlet for such feelings which have been denied healthy expression in daily life." Latest research shows that missed sleep of a night results in more dreams next time round.

"Healthy people don't act out their dreams because the brain has a mechanism for immobilizing the body during the dreaming stage of sleep." When this mechanism malfunctioned, "one patient kicked a hole in his bedroom wall, while another tried to choke his wife." Such situations need medical consultation. Some scientists consider "Out of Body Experiences" (OBE) to be similar to dreams. "The vivid body and world of the OBE is made possible by our brain's marvelous ability to create fully convincing images of the world, even in the absence of sensory information."

No single theory is fully accepted regarding the usefulness of sleep. Brain consumes maximum energy out of the food you eat. Sleep appears to help in saving energy consumption. Latest Magnetic Imaging studies support this contention. Dr. Siegel of California thinks that sleep is related to repair of oxidative damage in the brain caused by daytime activity. Dr. Walker found that "Lack of sleep may cause some psychological disturbances." Dr. Tononi says that, "When we're awake, different parts of the brain use chemicals and nerve cells to communicate constantly across the entire network. In the deepest part of sleep, however, the various nodes lose their connections. The brain breaks down into little islands that can't talk to one another." We experience this as Deep Sleep. Dr. N.P. Franks of London reported in April 2008 that "that there are striking similarities between anesthetic-induced loss of consciousness and deep sleep."

To appreciate why dreams evolved, imagine yourself in the primitive caveman days without TV, telephone, houses, roads and nothing to do. You are exposed to life-threatening dangers of the raw wild. Finnish psychologist Dr. Revonsuo proposed that dreaming evolved as a survival tool under those circumstances. It helped "in rehearsing threatening situations, so that the dreamer can better handle them in real life" later. Dr. Stevens compares dreaming to 'off-line' processing. Dr. Scaruffi adds that we essentially carry the same old ancient brain, which evolved biologically millions of years ago. "Therefore, it still generates the same flow of emotionally-charged flashes of reality." Dr. Winson postulates that "First the brain started dreaming, then dreams took over the brain and became the mind." So he says, "Maybe the mind is simply one long, continuous dream of the universe."

Thus if all parts of the brain are active, it is wakeful state. If the sensory cortex is at rest with other parts working, it is dreaming; if, in addition one or another part malfunctions, it is OBE, near death experience (NDE) etc. If only a few isolated nodes in the brain function, it is deep sleep. If the brain is totally inactive, it is death! Brain cells generate a large amount of waste in wakeful state. During deep sleep this garbage is removed and the cells get rejuvenated. You wake up refreshed and your brain is ready to protect you for another day. Mandukya Upanishad compares the three letters, A-U-M to Wakeful, Dream and Deep Sleep states in that order. Actually, dreams follow, but not precede Deep Sleep. If we neglect the initial drowsy period, we go through four or five cycles of deep sleep and dreams every night. Each cycle lasts for about 90 minutes. So it is more like AMU-MU-MU-MU and not AUM in daily life.

## 21. YOU ARE A WALKING ZOO

I bet you never visited a bigger zoo than what you yourself are! The number of animals on you, in you and all over you is ten times more than the number of your own body cells. You are a home for 500 to 100,000 different species! They add 3-4 kilos to your body weight. We are of course talking about microorganisms. Some scientists think that man is not a single individual but a "Walking Superorganism – a highly complex conglomeration of human cells, bacteria, fungi and viruses." The microscopic germs we carry are so small that the dot over "i" may hold nearly a million of them. Can a cloth around mouth keep them off as some persons believe? Let us take bacteria as an example and find out the truth.

Our skin (especially sweaty areas), eye lashes, nose, mouth, digestive tract and urinary organ are the sites where maximum bacteria live. The good news, however, is that much of these bacteria are useful or otherwise harmless to us. Human skin contains many tiny vacant places. If harmless bacteria do not occupy those sites and act as security guards, harmful microbes could have invaded and destroyed our body. Mouth contains about 500-600 kinds of bacteria. They produce tartar and plaque. Stomach does not harbor many bacteria because of its acidity. But *Helicobacter* bacteria are one that has learnt to live by burrowing into the stomach wall. This germ has been with man ever since he moved out of Africa about 60,000 years ago. It modified itself to be able to survive in the stomachs of people living in different climatic regions. German Scientists recently developed a method of mapping the spread of man from Africa tracing the changes in *Helicobacter* and concluded that man migrated to Europe via Central Asia. *Helicobacter* is said to be the cause for ulcers in our stomach. But a research report just released gives it credit for protecting us from cancer!

Our small intestines and colon are a haven for bacteria. More than 1,000 species of bacteria sit here. Without these bacteria we would have been unable to digest the food we eat. These bacteria break down some sugars and other foods and convert them to a form suitable for absorption by intestines. One type of bacteria produces vitamin K necessary for blood clotting. Another produces vitamin B. It is good, therefore, to eat fermented foods (*idli*, *dosa*, yogurt etc.) that contain bacteria useful to us in our digestion. How well we can draw energy from the food we eat depends on the type of microbes in our gut.

Dr. Gordon's experiments indicated that dominance of certain microbes in the gut could contribute to obesity.

The only sterile environment we ever lived was when we were in our mother's womb. Ever since we are born, every touch by the mother or any person would add new bacteria. "Mothers around the world go armed with anti-bacterial gels, sprays and baby blankets" with a fallacy to keep the baby infection-free. "But recent research shows that society's anti-bacterial and anti-infection crusade makes children and adults more likely to develop asthma and allergies - and perhaps even mental illnesses," says Dr. Callahan, who studies bacteria and infectious diseases. Dr. Lowry from Bristol University found a type of friendly bacteria in soil that works like antidepressant. "This leaves us wondering if we shouldn't all be spending more time playing in the dirt," he jokes.

Apart from digestion, microbes also assist us in many other ways in the day-to-day maintenance of our body. It would have been a far bigger struggle for us to live totally bacteria-free. Colonies of bacteria work together collectively as a community in influencing our health according to Dr. Relman of Stanford University. This necessitates a reassessment of how we treat infections. In case of ill health, we have to first know if there was a change in the population pattern of bacteria in our gut. Many times it becomes necessary to "restore the microbial community in the body to its normal state so that we regain our health." No wonder the doctor prescribes a dose of live yeast (fungi) when kids who are born and brought up in the USA develop an allergy after eating some yummy dish prepared by their Granny in India.

There are more bacteria in the world than any other living thing. Quite a number of them are harmful to us. Dr. Callahan of Colorado University cautions, "We are a minority on this planet, and we must learn how to work with the majority." His advice is to be on a constant vigil: "We understand that part of becoming an adult is learning to interact with people and recognize both bad and good in those people. The same is true for bacteria and other infectious microorganisms."

In an evolutionary sense, we are very much what we ate, according to Prof. Leonard. Differences in food contributed to the evolution of man from apes. Intestinal bacteria harbored by people who practiced farming in ancient times and ate essentially carbohydrate

food would be different from the intestinal flora of meat eaters (hunters). People who developed animal husbandry and were accustomed to consume dairy products would have more of lactobacteria that helps in digesting milk proteins. Experiments with mice showed that food has an effect on triggering gene activity. We differ enormously from Chimpanzees, though 99% of our genes are common possibly because of the differences in the type of food we eat.

Vyasa described three types of foods in Bhagavad-Gita (Ch 17, verses 7-10): *Sattvic* that gives health and happiness; *Rajasic* that produces pain and disease; and *Tamasic* that causes unwelcome temperament. However, our choice of food would depend not only on us but also on the creatures we host in our gut!

## 22. WHAT YOU THINK, THAT YOU WILL BE

Our genes know us like seeds know the plant. Genes instruct each cell of our body on how much and when to produce the 100,000 odd proteins that define what we are – in both behavior and looks. Our skin color, color of the eye or hair is decided by genes. It's the genes that make you religious or alcoholic. If you are slow in studies, blame it on your gene. If you are irritable, yes, it's a gene. Genes can cause diabetes or Alzheimer's. Everyday a gene gets identified as reason for some disease or character in us.

We inherit our genes from our parents. We have no hand in it. So, we are nothing but mere helpless puppets controlled by genes. Hence, we should not be held responsible for any acts of omission and commission because it is the genes acting and not we. This argument totally contradicts the rationale of our penal system on culpability!

Obviously there is something more to it. For, consider this: Chimpanzees and we differ only by about one percent in our genes. We have only slightly more than twice the number of genes compared to what an earthworm has. By any measure we, human beings, look and behave far different from these animals than what the mere number of genes would indicate. There must, therefore, be something more than the genes acting.

Undoubtedly genes are in full control immediately after conception. But genes alone do not determine our health and well-being throughout our life. For example, identical twins possess exactly same genes. If only genes determine everything, one would expect identical twins to have exactly the same characteristics all through their lives. But this is not so. Though the twins might be "indistinguishable during the early years, they exhibit remarkable differences" with age. So what is important is not the presence of a gene but whether it gets switched on or not to produce a given protein. Nobel Laureate, Dr. Kandel says that environmental stimuli turn the genes on and off. One study in USA records that "In most cases, getting or avoiding a disease depends not just on genes but on things within your control, such as diet, exercise." Hence environment has a major role in shaping us to be what we are.

Environment affects us even before we are born i.e. when we are still a fetus in our mother's womb! Talking about the environment in which a fetus grows, Dr. Nathanielsz observes that "the physical, hormonal and even emotional interactions between a mother and her child in the womb have a concrete effect on that child's physical and mental health". Therefore, it is very important for mothers to have healthy nutrition, happy attitude and positive feelings so that the baby born will develop to be a happy individual. The way a child is brought up also impacts its character. Dr. Richards finds that proper nurturing of the offspring turns on the glucocorticoid gene which helps in handling stress. Not enough nurturing and grooming, the gene never gets turned on and the child grows to roll in uncontrolled emotions.

Epigenetics is the new Science that studies the influence of environment on genes. There are about 25,000 genes in us. Genes exist as stretches within a long chain of chemical molecules called Deoxyribonucleic Acid (DNA). DNA occurs tightly coiled around protein spools in every cell of our body. Spool protein, coil tightness and neighboring DNA are three factors that help or hinder genes in their activity. These factors in turn are affected by chemicals in the environment. Environment thus exerts indirectly its influence on genes. Dr. Newberg found that certain odors in the environment caused characteristic emotional responses: lavender evoked feelings of relaxation and calm while acetic acid raised feelings of anger and disgust. In a report published in May 2008, "an international team of scientists described how burning frankincense (resin from the *Boswellia* plant) activates ion channels in the brain to alleviate anxiety or depression. (Reason enough to light incense sticks at the time of meditation!). The work of Dr. Han-Seok Seo and others reported in June 2008 showed that simple inhalation of coffee aroma alters the activity of genes in the brain.

Dr. Li-Huei Tsai's work recently confirmed that enriched and stimulating environment for children helped the growth of new neuronal connections in brain, contributing to improved memory and learning capability. Dr. Kandel showed that learning alters nerve connections resulting in behavioral changes. A consortium of scientists from Germany, Japan and China reported in April 2008 that many enzymes determine whether genes are turned on or off during development or under disease conditions.



“Researchers have long investigated the molecular mechanisms involved in monocular deprivation - when one eye is deprived of light during a critical period of brain development, that particular eye becomes permanently blind, even after it is uncovered. This phenomenon is considered to be an important model for brain development because synapses for the covered eye — deprived of environmental stimulus, or what Dr. Sur calls “nurture”— shrivel up or get reassigned to other uses.” It was, as though, as per a report in Aug 2008, “the eye is telling the brain, “The eyes are ready and seeing properly — you can rewire now.” “The eye is telling the brain when to become plastic, rather than the brain developing on its own clock,” says Prof. Hensch, who is at Harvard Medical School.”

Dr. Dean Ornish of the University of California, San Francisco and his colleagues found that after three months of life-style change (diet, exercise, company etc.), the activity of more than 500 genes was altered in the prostate in a way that might be expected to help fight cancer. The good life turned off tumour-promoting genes (known as oncogenes) — including several that are the target of efforts to develop anti-cancer drugs. In addition, disease-preventing genes, including one for a protein that may help the immune system to recognize tumor cells, were switched on. Exactly how changes in lifestyle have this effect on the genes is unclear. In June 2008, Dr. A. P. Feinberg and other researchers at Johns Hopkins reported, “epigenetic marks on DNA do indeed change over a person’s lifetime.”

Latest report (2008) on the drugs taken to boost an athlete’s performance showed that it might be caused by placebo effect, “This finding really shows the power of the mind,” said Dr. Ken Ho, an endocrinologist at the Garvan Institute in Sydney, Australia, who led the study. In a study published in August 2008, “groundbreaking research involving McMaster University researchers shows that a specially designed video game can promote positive behaviour in young cancer patients that enhances the effectiveness of medical treatment.”

Dr. Lipton carries the environmental effect a step further - from physical to mental. He says, “DNA is controlled by energetic messages emanating from our positive and negative thoughts.” Much of latest research seems to support this view. Dr. Benson, Dr. Zubieta and many scientists found that positive thoughts induced release of more natural painkillers and dopamine in the brain. (Dopamine gives a sense

of well-being). By conscientiously directed thought akin to meditation, Dr. Schwartz is able to successfully treat patients of chronic mental disorders.

Negative thoughts, on the other hand, damage the body. If we entertain images of disability and despair, body produces toxins and we do become sick! Dr. Blackburn and her team recently discovered that “chronic stress and even perception that life was stressful” affected every cell in the body. Cells lost their ability to replicate and turned old sooner! Dr. Davidson’s group at Wisconsin convincingly proved the effect of meditation on brain. These examples underline the importance of mental environment (our attitude and thinking) in triggering genes.

As thoughts can influence genetic dispensation, we better watch our thoughts. Upbringing, culture, peer pressures, social relationships etc. largely govern our thinking. Hence we should be discrete in the associations we develop and maintain. We should look towards those who can facilitate wholesome ‘thought environment’ conducive to negating genetic compulsions and can lead us to achieve happiness. Commenting on a just published research study on the role of a gene that influences depression in patients, Dr. John H. Krystal, Editor of *Biological Psychiatry* said, “This is exciting new evidence that genetic and environmental factors may interact to produce specific and long-lasting modifications in brain circuits. Further, these modifications may shape the course of one’s life in extremely important ways, including increasing the risk for major depressive disorder and perhaps suicide.”

*Sanchita* karma is long-term accumulated storage of the effect of past actions. That’s the record the genes contain. It manifests 100 per cent at the time of conception and constitutes *vasanas*. Environmental interactions and thought processes initially in the mother’s womb and later in the world modify *vasanas* to produce *Prarabdha*, current sufferage. Freedom from the genetic dictate of birth-cycles (*samsara*) is Nirvana, a total burn out of *vasanas*. *Satsangatya*, scrupulously chosen high-quality environment that we associate with, strengthens our thought-processes in surpassing the genetic code. Maitri Upanishad declared long ago, “What a man thinks that he becomes: this is a mystery of Eternity.”

## 23. THE ARROW OF TIME

“Time and tide wait for none” is a well-known adage drilled into our heads even before we are old enough to grasp its meaning. Time’s up – run for breakfast, run for school, run for the meeting, run to beat the deadline and so on it goes. “Run”, “run” is the mantra we chant. For, the clock always moves forward. Bygone yesterdays wouldn’t return. We become slaves to the irreversible arrow of time.

Is this arrow real? Or we made it up?

Amongst ancient civilizations the Chinese kept meticulous chronology. But Indians, writes Dr. George Sudarshan, believed that “time as experienced depended on the state of awareness of the individual.” Modern Cosmology tells us that ever since the Big Bang of creation, our universe has been expanding. Expansion results in increasing disorder like a fallen cup breaking into many pieces. With time the pieces do not combine to become the whole cup back again. So the one-way irreversible arrow is a consequence of the Big Bang. Quantum Physics, however, makes a mockery of our ideas of rigid one-way time. Subatomic particles appear to travel from present to the past or from future to the present!

We detect ‘change’ against the backdrop of time. And ‘time’ is deciphered only if there is a change. If nothing changes, no time can be noticed. Prof. John Wheeler, the famous Physicist said, “Time is the book-keeper of change.”

We think that our world has certain characteristics. It is we that ascribe these characteristics based on our sensory perception. The sense organs and the characteristics attributed are:

Eyes: Light and colors; Distance;

Ears: Sound.

Skin: Heat; Pressure.

Tongue: Taste.

Nose: Smell.

In addition, we think “time” is another characteristic of our world. Have you ever wondered what is that organ we possess to sense time? None I am afraid.

Ours is a three dimensional world. Suppose we can see only two dimensions. With 2-D vision, we would not be able to see three sides - length, breadth and width – all at once. If we look at a loaf of bread, only the front face of the first slice would be visible. We may gather an idea of the whole loaf moving slice-by-slice in our mind in the third direction. So depth as a stack of 2-D slices is an inference of the mind. Thus mind helps us to perceive depth as an extra dimension in a 2D-world.

Similarly, mind helps us to see an extra dimension in our three dimensional world. We call that extra dimension TIME. Actually we see the world in 3-D slices. Mind provides an imaginary continuity progressively linking the current 3-D slice to the preceding 3-D slice. Mind also interprets the present event to have emerged out of its predecessor and builds a story that the first event is the cause and the second is its effect. A cause-effect relationship gets established generating the feeling of ‘the arrow of time’.

If the mind fails to intervene, there is no ‘time’. For example, when the mind is snubbed or stunned, as in an altered state of consciousness (say under anesthesia) or under sudden life-threatening situations, it loses all sense of time. So time is only an imaginary construct of the mind!

Yogavaasishta tells the story of how Sage Gadhi was puzzled to know from Lord Vishnu that ‘time’ was a mental construct of man, a Maya. A long conversation ensues between them.

**Gadhi:** “My Lord! Everything in the world like growth, seasons, and crops happen based on time. How can time be my imagination?”

**Lord Vishnu:** “Your mind is the one which conceived four directions within one whole undivided space. Based on those fictitious directions, your mind calculates the motion of the sun. The motion is calibrated into day, night, weeks and years. Then you build up formulae of calculations. Is not this a conception in your mind?”

**Gadhi:** “Not really, Sir! Time is an experience. Measures and divisions could be my invention. There must be an infinite Time behind these divisions.”

**Lord Vishnu:** “Where does such infinite Time exist? If you agree that your mind did not conceive infinite Time, it should have existed prior to

your mind and the movement of sun. What does exist prior to these? Only Brahman! Therefore, you have to concede that infinite Time is Brahman, the only Reality. Divisions of time based on the motions of sun and moon are your mind's creation and are unreal."

Gadhi had to perform deep meditation to understand the full import of this teaching.

J. Krishnamurti admits 'physical time' involved in biological growth, technological progress, education etc. But he denies 'psychological time' implicit in 'hope' in realizing Truth. He says that 'psychological time' is a myth, an invention of 'thought.' He calls everything that thought builds up including the illusory world as 'real' and distinguishes it from Truth. Truth is not perceivable through time or thought.

Changing thoughts produce a sense of time in our mind. All 'Thinking' belongs to either 'past' (remembering, reminiscing) or 'future' (planning, projecting). Dr. McDermott showed through fMRI studies that brain draws on the same neuronal resources whether it thinks of past or future. So 'thinking' past or future, it's all the same to the brain. If the brain is in the 'Present', it is watching (observing). One may watch with a sense of "I am watching", reacting to what is being watched, judging and invoking memory. According to Advaitins, in watching with full "attention", no sense of a separate "I" sitting here and watching things 'out there' emanates. No 'thoughts' exist and it is beyond time. In that "plain watching" without a motive, without referencing memory, "what is", is Brahman, the Truth. Thought arising, Brahman becomes 'Time'. With Time comes Creation (Sloka 111, Aparokshanubhuti) or Dissolution (Bhagavad-Gita XI – 32).

## **24. PLEASURE OF SEX v. BLISS OF SELF IN BRAIN SCANS**

Khajuraho and Kamasutra fire the fancy of any foreign tourist to India. Add Spirituality and the heady mix becomes a killer app for seekers of quick-fix salvation. Biologically sex evolved as a reproductive mechanism to possibly capture advantageous heritable genetic traits from a partner. Only humans and very few animals like bonobos and dolphins indulge in recreational sex. Sex is closely tied to sensory perceptions and lies within the realms of mind. Salvation transcends both senses and mind. “Rajneesh, the ‘horse’s mouth’ concerning the topic of enlightenment for Westerners for many years”, regrets James Swartz, “wedded two largely incompatible concepts, sense enjoyment and enlightenment.” One may lose ‘self identity’ and get enwrapped in an inexplicable joy in either as Brihadaranyaka Upanishad (IV-iii-21) says. But the bliss of enlightenment and the pleasure of sensual gratification are totally different. Our brains show it up all!

Human brain is a mass of interlinked neurons piled up in three layers. At bottom is the most primitive brain common to all animals. The outermost covering (cortex) of the brain is divided into several lobes. The lobes have distinct cognitive functional areas; but no rigid walls separate them. The front lobe (behind forehead) having overseeing and decision-making function is well developed in humans. The top brain (cerebrum) comes parted vertically into two hemispheres. The right hemisphere is concerned with ‘NOW’, the present moment. Left hemisphere thinks analytically and also governs language. Constant inter-communication between both hemispheres provides a meaning to what we experience. Activities like sex or meditation involve many parts of the brain. No unique God-spot or Sex-spot exists within the brain.

Extensive brain scan studies were carried out on practitioners of various types of meditation – Buddhist, Christian, Hindu, and Sikh. Considerable work is done on Buddhist monks with over 10,000 hrs of meditative practice. I am, however, not aware of any brain scan studies done on a *Jivanmukta* (an individual who is said to have achieved Nirvana or Non-Dualistic “Awakening”).

The parts of brain that become active during meditation depend on the type of meditative practice of the seeker. In the monks who practiced focused meditation, “activity in the parietal lobe (which orients us in space) goes down. Activity in the frontal lobe involved in paying attention goes up.” Dr. Newberg opines that loss of orientation together with focused attention cause a feel of ‘oneness’ with the object of meditation. Similar results were noticed in the case of Franciscan nuns too. Pentecostal nuns who do not focus on any particular object in their prayer showed lower activity in the forebrain. Brains of those practicing Transcendental Meditation essentially as a relaxation meditation did not show much activity. Carmelite nuns who achieved Mystical Union could not, however, summon their communion with God within the scanner tube. Dr. Beauregard could only scan a recollection of their profound divine experience. The results showed activity in brain regions connected to learning, falling in love and social emotions.

Dr. Davidson mapped the activity in the brain of monk Matthieu Ricard, who has over 30 years’ experience in ‘compassion meditation’. “The pictures showed excessive activity in the left prefrontal cortex (just inside the forehead). Generally people with happy temperaments exhibit a high activity in the left prefrontal cortex, an area associated with happiness, joy and enthusiasm.” Scientists at Wisconsin reported that positive emotions such as loving-kindness and compassion could be learned the same way as playing a musical instrument.

Many epileptic patients with seizures in the temporal lobes experience intense religious feelings and calmness. Taking a clue from this, Dr. Persinger developed a helmet that produced electrical activity in the temporal lobes. Some volunteers wearing it did experience ‘cosmic bliss’. Swedish scientists could not replicate these results. There is a rare case of Dr. Taylor, herself a brain scientist, who had a stroke in 1996 due to hemorrhage in the left hemisphere of her brain. With only the right brain hemisphere functioning at the time of the stroke, she felt she lost her identity as a separate individual. She reported experiencing Non-Dualistic cosmic connection to infinite energy.

Admittedly a laboratory is profoundly an unsexy environment to study human sex, that too inside the claustrophobic confines of a scanner. Thanks to the Dutch scientists who successfully pulled off the impossible study, valuable data could be gathered on peak sexual performance of the volunteers. “Achieving orgasm involves more than heightened arousal. The brain’s pleasure centers generally lighted up

brightly in the brain scans of both sexes” reports Dr. Holstege. In the male volunteers “extraordinary activation of the brain’s reward circuitry during ejaculation was noticed” accompanied by high activity in regions connected with memory. In contrast, “when a woman reached orgasm, much of her brain went silent” indicating relaxation and overcoming of inhibition. Brain regions related to bonding with partner were also lighted up in the female.

It is clear from these studies that brain records religious highs and sexual pleasures differently. Does it mean that God-feeling in our head is nothing more than a few chemical signals and electrical pulses in our neurons? Can misfiring neurons create exalted religious feelings like in those of Moses, Muhammad and Buddha? We do not know. Nevertheless, we may expect the lofty capstone of religious experience to leave its footprint in the brain. This does not mean that knowing which part of our brain gets activated during Nirvana in any way lessens the reality or beatitude of Nirvana. Man set foot on the moon almost forty years ago and found it to be no more than a crater-covered lifeless dusty place. Did it in any way lessen the poetic charisma or romantic inspiration of the Moon?



## 25. THE FOUR OUTCOMES

The Descartes' idea of body (or matter) - mind duality is not considered valid anymore by many neuroscientists. Mind is what the brain does - in essence the neuronal electrical and chemical activity. However, the word 'mind' itself requires a more precise definition. It is not yet known as to how the electrical firing that takes place in the neurons gives rise to "mind".

Yet mind is the only tool that is at our command for an investigation into what it is. Mind acquires its knowledge from the inputs received through the five sensory organs. The bandwidth of these organs being very limited, mind too is constrained in its ability in comprehending many issues, if the issues are beyond these bandwidths. Our ancient Rishis, in their quest to find the ultimate truth, used the term "mind" in a variety of meanings. Mind is divided into several levels (or parts). Some sages postulated the existence of states beyond what we normally perceive as "mind". Yet some others went to the extent of saying that other than mind there was nothing else, nor even creation (Gaudapada Karika on Mandukya Upanishad, Ch.III)!

An attempt is made here to understand that state of mind where truth can be realized, at least at an intellectual level, by constructing an approximate model assuming body--mind duality somewhat on the lines of Gaudapada's Karika (commentary) on Mandukya Upanishad. The neuropsychological stance does not, however, invalidate the model.

Broadly speaking, at an aggregate level, a human being can be viewed to be composed of two entities:

- i. An ensemble of all the sensory and action organs - collectively called "the Body"; and
- ii. An ensemble of all our knowledge, experience, memory, culture, thoughts, emotions, 'qualia' - collectively called "the Mind."

These two entities can be either in an active state (existent) or in rest (inert or non-existent) state. The two entities and the two states together can give rise to four outcomes.

The four outcomes are:

- a. Mind and body both active: Wakeful state.
- b. Mind active but body inactive: Dream state.
- c. Mind and body both inactive: Deep sleep, buddhistic satori, *Nirvikalpa samadhi*, and finally death depending upon how inert or nonexistent, the condition of the entities is.
- d. Mind inactive or nonexistent or totally at rest, but body active: the state of Nirvana or non-dualistic Brahmi state. In this state, life and its processes continue in the body but the mind and the ego are non-existent or totally inactive.

We are all aware that the first three states are mutually exclusive, except in certain rare pathological condition of the brain. That is to say that a person cannot simultaneously experience two or more states. We do not make any special intentional effort to shift from state to the other (e.g. we do not decide to dream or go into deep sleep. Those states just happen). Likewise, the fourth state too can be experienced without any particular effort. Only when we consciously try to attain a specific state that we lose it!

Each state is real on its own terms. Unless we posit an artificial reference extended from one state to the other for judgment, we cannot say that a specific state is real and the other is unreal. Each person experiences the state and lives in it by oneself. Just as it is impossible to prove sleep or dream state to the sleeping or dreaming individual by any external agent at the time of his actually sleeping or dreaming, it is also considered to be equally impossible for an external agent to demonstrate the fourth state. Vyasa, the great storyteller that he was, showed this very well in the eleventh chapter of Bhagavad-Gita. The chatty, questioning, inquiring Arjun was totally silent when he experienced the cosmic "*Viswarupa*" (i.e. when he was in the fourth state). Vyasa uses the technique of narrating the experience of Arjun in the fourth state through the words of Sanjaya.

A question will now arise as to how can the body act when the mind is inert in the fourth state? We have the answer in the Bhagavad-Gita. The actor in such a state remains satisfied with what comes of its own accord effortlessly. "Content with what comes to him, unaffected by the pairs of opposites, even-minded (non-reacting inert state), though acting, he is not bound (Bhagavad-Gita IV - 22)". Such an action is

considered to be inaction! As a matter of fact, an inherent 'Awareness' in the body-mind system which is independent of the state of both the body and mind exists in all the four states. Mind being absent in the fourth state, the body functions purely under the intrinsic 'Awareness'. An individual who conducts himself in this fashion in the world is called a Jivanmukta (i.e. liberated with his body still existing).

The sensory signals (visual, audio, etc.) inputted into the respective cortex of the brain take a few hundred milliseconds before they are interpreted to give rise to a meaningful understanding of what we see, hear, et cetera. In that fraction of a second, perception and other cognitive processes take place within the brain. If the signals through the sensory organs are received but if subsequent processing is eliminated by the thalamus, neocortex, et cetera, the sensory organs will be acting as mere peep-through windows. They do not interpret a meaning to the input signal.

In the absence of a meaning to what is perceived by the senses, a distinction between what is perceived and who perceives is lost. No spatial separation between the source of the signal and the "self" as a distinctly different receiver of the signal is felt. No separation within the ambient objects is experienced by the observer from the signals emanating from various objects. In this state obviously, only a Oneness exists between the signal receiver and the signal emitters without a line of distinguishing demarcation between different objects. Therefore, this state when the mind (and attendant neurophysiological processes) is absent may be the state of Nirvana. The person does not experience individuation and will be inseparable from all the things around. So what remains is One Great Whole. Could the absence of neurophysiological processes of cognition and giving meaning to what is perceived offer a definition of the state of Nirvana?

## 26. INFIRMITIES IN KARMA THEORY

**ABSTRACT:** *Karma theory is quite popular in many eastern religions and gaining coinage with some of the new age gurus. But it looks to be based more on the Newtonian concepts of action-reaction models and irreversibility of flow of time. Both these assumptions appear to be based on shaky premises. The work by behavior scientists, particularly Cziko (2000) applying Darwinian and Bernardian principles shows that living organism's output is not determined by environmental input as a one way cause – effect model. Living systems are characterized by circular causality. This means that perception and behavior reciprocally and simultaneously influence each other. The one way cause – effect view of karma theory negates the intelligence and purposefulness of human behavior either in the 'here and now' or in the long term evolutionary perspective. "What is clear is that the currently accepted one-way cause-effect model, successful in explaining much of the workings of the inanimate world, cannot account for the purposeful, goal-directed behavior by which living organisms control important aspects of their environment."*

*The concepts from physics on multiverses, quantum theory and studies on the brain question the irreversible arrow of time as a dimension extending infinitely independent of space. Unless some new concepts develop to the contrary, reestablishing Newtonian view of the absolute nature of time and space, it is difficult to explain the present as the result of some past. In view of these findings, the validity of Karma theory needs to be re-examined.*

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1. **INTRODUCTION:** The Law of Karma enunciated by the Eastern Religions (particularly Hinduism, Buddhism, and Jainism) is generally well accepted and believed in by many. It has become quite popular even with New Age Gurus in the West (e.g. Zukav, 1990). Expressed in simple terms, Karma Theory says that our present is the effect of our past actions. We reap the consequences of our current actions later, may be even in the next birth. We, in many situations around us so often, encounter daily some effects that can be directly linked to some past causes. As an extension of such an experience, we tend to accept the karma theory without a question. Further, it quite often provides a comforting explanation to many of our imponderable experiences soothing a bruised ego and/or offering solace to our distressed souls.

The inexorable cause-effect relationship of karma is so much ingrained into the lives of the believers that they accept it at all levels, even at simple matters like missing a bus or spilt milk. However, we do not invoke karma for things which are under our control! May be because of this, in developed countries, where more things of daily life are under control, we do not find people so frequently alluding to their fate with their hand to the forehead (where the effects of karma are supposed to have been indelibly written down).

The Karma theory is based on two important implicit assumptions.

**2. THE FIRST ASSUMPTION :** The first assumption is that we, human beings, are helplessly subjected to the one way action of cause and effect, just like the inanimate things that we see around us are. That means we humans, with all our evolutionary skills and survival tools at our command and the enormous information stored in our genes and brain, are no different from the inanimate things subjected to the Newtonian law of forces.

In order to understand clearly, let us take a couple of examples. Iron filings get attracted to a magnet. The cause is the magnet. The effect is the filings stick to the magnet. If a sheet of paper is placed in between the filings and the magnet, the filings are still drawn towards the magnet but get stuck to the paper instead of reaching the magnet. But a Romeo attracted to a Juliet tries to reach Juliet even if a wall exists between them. He uses his intelligence to cross over the hindrance but does not stupidly end up sealing his lips against the wall like the iron filings sticking to the paper. Unlike a stone dropped from air, an eagle diving for its prey in the waters does not hit just the water pool but constantly varies its flight path to catch the fish. That, in essence, is the difference between animate and inanimate systems as expressed by William James over a century ago (1890). Living beings constantly change their behavior to control their perception of the environment so that the set goal could be reached. In other words, they have a fixed goal but variable means unlike the inanimate things which follow a fixed path and end up with variable goals.

**3. PERCEPTUAL CONTROL THEORY:** In the case of living things, the cause – effect model works as a closed system with a feedback loop. ‘Approaching living organisms as purposeful systems that behave in order to control their perceptions of the external environment provide a new perspective for understanding what, why, and how living things, including humans, do what they do.’ Purposeful behavior has a circular causation.

Further, unlike non-living closed loop control systems (which are controlled by the environment), a living system is controlled from within itself. This is a direct reversal of the concept that our perceptions of the environment control our behavior. We vary our behavior to control perceived environmental consequences of those behaviors for a purpose. This is called “Perceptual Control Theory” (Cziko, 2000). The purposes and goals may be nested, that is to say that there may be many lower level goals within the overall higher level purpose.

One may suggest that the karma theory is more than just a cause – effect relationship. It has, for example, a regulatory role with promises of reward-punishment built into it to ensure an orderly society. But a very large amount of research work by behavioral scientists shows that attempts to modify human behavior by promises of rewards or threats of punishment have failed over time. Quoting from Cziko (2000), “It is not the provision of past rewards and punishment that influences behavior, but rather anticipation of future rewards and punishment. Public hangings can be quite effective in getting the population to think twice about performing acts that are punishable at the end of a rope (it is, of course, completely effective in preventing such actions in the future by the punished individual). Promises of future rewards can also increase the likelihood of certain activities (which is how most religions operate to modify the behavior of their adherents, not to mention the threat of hell as future punishment). The reason why rewards and punishment often appear to be effective in modifying or controlling another person’s behavior is not because their application in the past controls current behavior. Instead, humans vary their present behavior to obtain (or avoid) that which they want to obtain (or avoid). That is, rewards do not control behavior. Rather, behaviors are used to control rewards.”

The punishment-reward system may work for some time, though. But after certain point of time, it will lead to counter-control by the victims – a common example of such counter-control being strikes and *satyagrahas* (protests). As noted by Cziko, “Another aspect of trying to use rewards to control behavior is often overlooked and may actually go a long way toward explaining why it is ineffective in the long term. For me to use reinforcement in an attempt to control your behavior, I must be able to control the resource that will serve as the reinforcement and make sure that you are in a state of deprivation. That is, I must make sure that you have less of the reinforcement than you want. I cannot use food as reinforcement if you are able to obtain all the food you want from other sources. Whereas such an arrangement may work well for a rat or pigeon

that cannot question the fairness of such a situation, you as an intelligent adult human being will almost certainly find such a situation unfair, if not intolerable." If the promised rewards are of a deferred type, deferred to some unknown, unknowable and unverifiable future like next birth, like in the Karma theory, the system is sure to fail the moment faith in the system is weakened.

4. REBIRTH FOR WHOM? : Here a short digression on "Rebirth" is in order because Karma theory has an underpinning of rebirth for the remotely deferred effects of the actions done in the present life. Let us examine for whom or for what entity is rebirth possible.

Bhagavad-Gita is one of the basic trios (*Prasthanatraya*) of ancient Hindu thought. It is considered to be a summary of all the Upanishads. Chapter II of Bhagavad-Gita, in turn, is said to be a gist of all Gita. Going by Slokas 16 – 21 of Chapter II, we find that only two entities are projected in the discussion. One is 'sat' and the other is 'asat'. Their respective attributives are also clearly spelt out in those slokas. 'Sat' is existent. 'Sat' is not born, does not die; not having been, it does not come about. It is unborn, ancient, eternal, changeless, indestructible, illimitable and so on. On the other hand, 'asat' is non-existent, has forms and names, it is destroyed and has an end. It is impermanent and limited. No third element is postulated. So called Jiva (or Atman) is also Brahman (Sat). By the very nature of the description, there is no question of any birth, leave alone rebirth for "sat". 'Asat' having no existence and being impermanent cannot be reborn when it ends once. Then for what or whom is the rebirth possible? Unless we bring in a third hypothetical entity which can carry forward the deferred punishment-reward system or the balance sheet of karma and also postulate some continuing method of keeping its identity, it is not possible to have rebirth. All such hypothetical entities and associated postulations complicate the system and make it all the more doubtful.

The corresponding elements for sat and asat in the human beings are *saririnah* (the resident or owner of the bodies) and *sarirah* (the bodies). The *saririnah*, being *sat* is by definition free from birth or rebirth. If an entity representing *sarirah* (bodies) can at all possibly have rebirth, what part of *sarirah* could it be? The phylogenetic evolutionary memory is preserved in the bodies as its genome. The physical and mental characteristics of a person that have a large limiting influence on the quality of actions (karma) of an individual (i.e. emotional nature, physical

health or even issues like color of skin or eye) are dependent on his/her genes. The genes themselves are *asat* and they die when the person is dead. If some part of this individual has to carry forward the effects of his/her actions, it becomes necessary to some extent that a set of these genes should continue into his/her next life. How could the genes which end with the death of the person get carried on to the next birth? Even if we assume that the genetic material has been somehow carried, the person then has to be reborn into the same set of genes with the implication of inbreeding in the family. The theory of Rebirth hardly talks of any such genetic restrictions. In fact, some versions of the theory would even not restrict the scope of rebirth into any other form (including inanimate body).

Two other pertinent comments in this connection are:

i) WHO PAYS FOR MY SINS? :Let me say that I have sinned and there is not enough time left in this life of mine to reap the consequences. Therefore, I have to suffer the effects in my next birth. As per the Karma Theory, the balance of my karma is carried by a subtler entity as '*vasanas*' to be transferred to my next life. Let us call this subtler entity as "A". "A" is not ramesam, the physical body who committed the crime. "A" has not died with the death of ramesam and is not destroyed when the dead body of ramesam is burnt. Hence A is not ramesam. "A" is different and independent of ramesam. That much is easy to agree.

Now to suffer the consequences, "A" has to transfer the balance sheet of '*vasanas*' to some substratum. Let us say it landed on a beautiful table of a newly married couple who have, with all care and love, been keeping the table. The table reaps the consequences, gets deformed, despised, humiliatingly thrown away as pieces and destroyed. Now, "A" is not the table. "A" does not get destroyed with the table as it was not destroyed with the physical ending of ramesam. Table is not that physical ramesam who committed the sins. But it paid for it. If the inanimate table looks odd, let us replace it with the embryo formed from the sperm and egg of the loving couple. Let us name it as "B" just to aid in our analysis. Now this "B" is not that ramesam. In fact, it has just as much relation to that ramesam as the table in our example had to ramesam. Once again, let us remember "A" is also different and independent of "B". "A" is as removed from ramesam as from "B". Then is it not as illogical for the physical body of "B" to pay for the sins of the physical body of ramesam as it was for the table? Why should the body of "B" go through the suffering of disease and destitution in this world for the wrongs of ramesam after his (ramesam's) end? (Even if additional bodies of subtler levels like etheric, astral, mental



etc. are invoked, the same logic holds good for the finer layers of “A” which may be likened to a “messenger particle” as physicists would have called).

Does this not mean that others pay the consequences of my sins, immoral, unsocial acts? Is this the real moral behind the Karma Theory — some one or other suffers the consequences of wrong doings in a society, so better everyone behave well.

ii) DOES NATURE WASTE RESOURCES? : For the consequences of good and bad to be enjoyed or suffered in the next life, let us see how the natural resources get expended in order to do justice.

Just for simplifying the arithmetic involved, let us assume an average life of an individual to be 60 years. (We may estimate the numbers for any other assumed age, but what is important is the concept here). A third of human life, on an average, is spent in sleep. That means we have 40 years of active life. Again, out of these forty years, a person spends at least 20 years of life after birth in learning things - right from how to sit, crawl, stand, walk, read, write, develop language and thinking abilities (because language has a great influence in our thinking as established by recent research work), social skills, etc. etc. That means another 20 years of life is gone in learning before an individual becomes independent to act in this world. Until then, he/she is under the care of parents or some guardians who have a vicarious responsibility for his/her actions.

Thus forty years or two thirds of a new life is wasted in learning or relearning the same old skills, before a person gets independent eligibility to pay for the consequences of the good and bad done in a past life. Does Nature waste its resources in this way – providing just a 20 year span for paying the consequences and investing twice that period repeatedly in cycles of birth in order to make the individual ready to reap the consequences?

5. THE SECOND ASSUMPTION : The second infirmity of the one way cause – effect model of the Karma theory arises from the concept of time as a unidirectional arrow. Special relativity a century ago demolished the classical view of absolute space and time. Time is no more considered independent of space — as a separate, one-dimensional continuum, extending infinitely in either direction. The latest developments in Physics throw further light on the fallibility of our concept of time.

6. **ARROW OF TIME AND PHYSICS:** Huw Price of the University of Sydney re-examined the issue recently in the context of quantum mechanics. He concludes that the idea that the past is not influenced by the future is an anthropocentric illusion, a “projection of our own temporal asymmetry”. The reason why the things we do in the present do not seem to have altered the past, according to his complex argument, is that the past has already taken account of what we are doing!

Direct cosmological observations are leading the astrophysicists to the high probability of the existence of other universes. The string theory in eleven dimensions and the theory of multiple universes being talked of in physics require us to understand time in a new perspective. In the words of Prof. Tegmark, (2003), “now you are in universe A, the one in which you are reading this sentence. Now you are in universe B, the one in which you are reading this other sentence..... All possible states exist at every instant, so the passage of time may be in the eye of the beholder”. So all events have occurred all at once! As expressed by the Physicist Deutsch decades ago, the many universes are a collection of moments. “There is no such thing as ‘the flow of time’. Each ‘moment’ is a universe of the manyverse. Each moment exists forever; it does not flow from a previous moment to a following one. Time does not flow because time is simply a collection of universes. We exist in multiple versions, in universes called ‘moments’.”

Piero Scaruffi (2003) points out our fallacy on time illustratively thus. “What would happen if the Sun all of a sudden slowed down? People all over the planet would still think that a day is a day. Their unit of measurement would be different. They would be measuring something else, without knowing it. What would happen today if a galactic wave made all clocks slow down? We would still think that ten seconds are ten seconds. But the “new” ten seconds would not be what ten seconds used to be. So clocks do not measure Time, they just measure themselves. We take a motion that is the same all over the planet and use that to define something that we never really found in nature: Time.”

7. **TIME IN MIND :** From neurophysiologic angle too, time appears to be a mental construct, an evolutionary tactic developed by our neural system to relate events/spaces by invoking continuity. Through millennia of years, we acquired several shortcuts to relate what is processed by the brain to our survival values in order to conserve our expending of energy (Ramesam, 2004). Let us take the example of our vision and how we link together through the sense of our vision disconnected 3-D space. As Ramachandran (2003) puts it, “the goal of vision is to do as little processing

or computation as you need to do for the job on hand.” He adds, “Vision evolved mainly to discover objects and to defeat camouflage. You do not realize this when you look around and you see clearly defined objects. But imagine your primate ancestors scurrying up in the tree tops trying to detect a lion seen behind fluttering green leaves. The brain says – ‘what’s the likelihood that all these different yellow fragments are exactly the same yellow simply by chance? Zero. They must all belong to one object, so let me link them together, glue them together. And as soon as you glue them together, a signal gets sent to the limbic system, saying ‘Aha, there’s something object-like, Oh, my god, it’s a lion – let me out of here!’ So there’s an arousal and an attention which then titillates the limbic system, and you pay attention and you dodge the lion. And such Ahas are created, I maintain, at every stage in the visual hierarchy as partial object-like entities are discovered that draw your interest and attention.”

One could easily extend that such linkages get formed not merely in the 3-D space but in the 4-D space-time. As expressed by Ramesam (2004), “we as humans can visualize only three dimensions. Because of this inherent limitation, our mind provides an imaginary continuity to the events and thus helps us to see an extra dimension called TIME. If the mind does not interpose, there is no ‘time’ in the sense that we see it (as an arrow). When the mind is snubbed or stunned, as in an altered state of consciousness (say under anesthesia) or when the mind faces sudden life-threatening situations, it loses all sense of time. Therefore, arrow of time is only a mental imaginary construct and not an independent variable.”

**8. CONCLUSION :** Karma theory is quite popular in many eastern religions and gaining coinage with some of the new age gurus. But it looks to be based more on the Newtonian concepts of action-reaction models and irreversibility of flow of time. Both these assumptions appear to be based on shaky premises. The work by behavior scientists, particularly Cziko (2000) applying Darwinian and Bernardian principles shows that living organism’s output is not determined by environmental input as a one way cause – effect model. Living systems are characterized by circular causality. This means that perception and behavior reciprocally and simultaneously influence each other. The one way cause – effect view of karma theory negates the intelligence and purposefulness of human behavior either in the ‘here and now’ or in the long term evolutionary perspective. “What is clear is that the currently accepted one-way cause-effect model, successful in explaining much of

the workings of the inanimate world, cannot account for the purposeful, goal-directed behavior by which living organisms control important aspects of their environment.”

The concepts from physics on multiverses, quantum theory and studies on the brain question the irreversible arrow of time as a dimension extending infinitely independent of space. Unless some new concepts develop to the contrary, reestablishing Newtonian view of the absolute nature of time and space, it is difficult to explain the present as the result of some past. In view of these findings, the validity of Karma theory needs to be re-examined.

An interesting question that may be posed here is what is the ultimate purpose or goal of our behavior, if, as animate systems, our actions are governed by a “purpose”. Biologists can hardly tell us the ultimate purpose or goal for evolution. It is in this sense blind. Our ancient Rishis, however, spelt out the purpose as liberation or salvation which is a ‘concept’ denied by thinkers like Mr. U.G. Krishnamurthy (Naronha and Moorthy, 1990.)

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#### **REFERENCES:**

- Cziko, G., (2000), *The Things We Do*, Bradford Books, pp.302
- James, William, (1890), *The Principles of Psychology*, quoted in Cziko, G.
- Naronha, A.P.F. and Moorthy, J.S.R.L.N., Editors, (1990), *Thought is your Enemy*, Sowmya Publishers, Bangalore, India (available online)
- Ramachandran, V.S., (2003), *The Emerging Mind*, Lecture:3 *The Artful Brain*, Reith lectures, BBC.
- Ramesam, V., (2004), *Religion Demystified*, e-Journal of Indology.net available at: [www.indology.net/article33.html](http://www.indology.net/article33.html)
- Scaruffi, P., (2003), *Thinking about Thought*, Writers Club press, pp.656.
- Tegmark, M., (2003), *Parallel Universes*, Scientific American Digital, May.
- Zukav, G., (1990), *The Seat of the Soul*, Free Press, pp.256.

## 27. MEDITATIONS ON ADVAITA

**ABSTRACT:** *Humankind has been exposed to the forces of nature ever since we made an appearance on the face of this planet. We find ourselves very inadequate in our struggle for survival. Disease and death are unavoidable. Happiness and pleasure are at the most momentary and fleeting. Endowed with a rare capacity of modeling internally, in our minds—through abstract thinking—the problem of “uncertain futures”, we search for coping mechanisms to overcome our limitations. Incisive logical thinking leads us to the surprise finding that nothing was ever created and all our troubles are the result of mentation, which is responsible for generating an imaginary “self”. We discover that the visible world is an illusion and that one is not really an individual but an eternal indivisible seamless One-Whole-Self experiencing an ineffable peace and inexplicable joy.*

*A few questions, however, remain: Are there two distinct ‘gateways’ of neuronal networks, one giving raise to “self” and another to “Self”? Could a shift in the operational focus from the node of an “individual self” to a “Universal Self” augmented by opioids like anandamide and neurotransmitters like oxytocin bring about a change in the perceived worldview? Is “negation of the visible world” a mere clever coping mechanism in the face of indefatigable misery? Or is there something unbeknownst?*

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Humanoids (our anthropological ancestors) first appeared on earth about two million years ago. Human beings came around 200,000 years back having diverged from their first cousins, Neanderthals, about 400,000 years ago. Modern man descended from a small group that lived in Africa. Driven by droughts, he spread to the rest of the globe in waves of migrations about 50,000 years back.

It is difficult to pinpoint exactly when the faculty of philosophical “thinking” about abstract issues dawned on humankind. Thinking, per se, predates Homo sapiens, as shown by the comparative studies between humans and chimps conducted at Emory University (Rilling, 2007). Marean (2007) reports evidence that goes back to 164,000 years “for the earliest cultural trappings of modern human species.” Cave paintings (evidence of memory and expression) date back to 82,000 years. Coulson (2006) found, in Africa, 70,000 year old relics of ritual worship indicative of “ability for abstract thinking.”

Neanderthals existed in Africa, Europe, and even went up to China. Krause (2007) found FOXP2 genes in Neanderthal remains from north Spain. This gene and the skull bone structure indicate that Neanderthals had language capability. In spite of that, Neanderthals totally disappeared about 30,000 years ago. Anthropologists ascribed many reasons for their extinction. Kuhn and Stiner (2006) recently suggested, after a detailed study of Neanderthal sites and artifacts, that they failed to develop division of labor between genders, a survival tactic successfully adopted by Homo sapiens.

From the beginning, humankind has struggled for existence. We were relentlessly exposed to the ravages of nature. We had to confront wild beasts and powerful predators. Inexorable natural processes were too daunting to our fragile and mortal bodies. Whatever might be the coping mechanism innovated, problems of “uncertain futures” (Plotkin, 1997) haunted us. Nature’s destructive fury seems inescapable, disease and death unpreventable and suffering and misery unavoidable. Everything around constantly changes; happiness and pleasure seem fleeting and at best only occasional. So, man in millennia past, explored for ways and means of surmounting such limitations.

The quest led to the discovery of a “self” within—a “self” that identified with the body, giving a distinct personality. The “self” is protective of itself and judgmental about whatever the senses observe. It seeks permanency. We surmised that misery emanated because of “self”. We want to rid ourselves of it. Someone said, “Our sensory system is the cause of a “self” within us. Therefore, burn the senses.” So they starved the body, mutilated the senses or practiced frightful rites. Others said, “Surrender “self” to a Supreme Being, who will take care of everything.”

Yet others said, “Thoughts emanate unstoppably. Thoughts give “name and form” to every sensory signal (sensation) received from outside; create a “self” and assess things in relation to “self”—friend or foe; mine or thine. “Self” thus distinguishes itself from the world “out there”. It tends to get attached to friendly objects for security. Why not find “something” unchanging and let “self” be attached to THAT instead of seeking refuge in ephemeral worldly objects? All problems would evaporate if we join the winner!”

Smart move indeed! So they searched for an eternal all-powerful ‘that’. Their astounding, unbelievable and counterintuitive finding at the end: “Nothing was ever born!” That outcome, in one-word, is the essence of Advaita.

Let us follow step by step their *Search*.  
 We begin with what is around.  
 A world out there is perceived.  
 Therefore, there has to be a 'Perceiver'.  
 Who is the "Perceiver?"

Our sense organs (eyes etc.) are not the Perceiver. They just receive the signals and pass on the info to the corresponding cortex ("*Indriya*"). The constant activity of neurons in the brain produces thoughts (*Manas*). The new input from senses is compared with the stored information in memory (*Chitta*). Memory is accumulated knowledge that was learned or experienced in the "past." It comprises both genetic and memetic (= cultural, religious, etc.) information. A final meaning to what we sense is assigned by intellect (*Buddhi*) interpreting the new information in relation to our Ego (*ahamkara*).

*Manas, chitta, buddhi and ahamkara* together give us the sense of I-ness (*Antahkarana*). Therefore, I-ness is merely an epiphenomenon arising out of the neuronal processes. It's not an objective entity.

Research by Tsien (2007), Nicolelis and Ribeiro (2006) established that hierarchical networks of neurons store info in a dynamic neurochemical environment. Neuroscientists like Drs. Heatherton, Lieberman (referred to in Zimmer, 2005) showed that there is no single identifiable 'spot' as "self" or Ego in the brain. Networks of neurons particularly in Medial Prefrontal Cortex work as "gateways" for information processing giving us a feeling of "self".

Thus, *indriyas*, I-ness and the non-existing "self" are all brain processes that help in our apperception of what is seen. They cannot be the "Perceiver".

Whenever we cognize a thing, we are lost knowingly or unknowingly in a process of comparing and contrasting what *is* seen *now* with the past which is dead and gone. So we never observe what *is*. Because of this process (which takes about a quarter of a second according to Prof. Crick), we are perpetually behind the "true" now. We live in a pseudo-now which is nothing but the past projected as present.

If we are "missing what *is*" because of this mentation, what causes Mind? Whatever that is, it must precede Mind.

Our Sensory system does not work unless we are Conscious. (So-called “unconscious” and “conscious” together constitutes Consciousness). What color, sound, language, texture or flavor is sensed is immaterial to consciousness. Like it makes no difference to an antenna what program it receives. Therefore, Consciousness is the detector “element”, the sensor and should exist prior to mind.

But Consciousness cannot function in a stand-alone mode. Consciousness requires a physical body (organism) and also “life-force” within that organism to manifest itself (a dead organism is not conscious). So consciousness and life-force must have come from something else. That “something” must have existed prior to these two.

That “something” should obviously be independent of both consciousness and life-force. That is to say it should be immaterial to that “something” whether an organism is living or dead. Therefore, it must be ever present and should transcend life, birth and death. That “something” is “Awareness”. Or call it by any other name you like.

Is there something prior to Awareness?

We have just no way of knowing.

Why?

We left the mind two stations behind. We traveled ahead transcending mind to consciousness and reached Awareness now in our analysis. Remember Mind is the mechanism that sustains an “identity” for “me”, defining my “persona”. Mind being no more existent at this stage, there is no scope for “I” to exist, for “I” lost its support structure. “I” being not there, there’s none to know anything. Awareness is not amenable to expression using such surrogates like words, symbols, and concepts because all these are within and limited to mind.

Mind being just a name for the mental processes and consciousness being just a neutral sensor, neither of them can be the “Perceiver.”

So the real Perceiver is “Awareness.”

Hence, Awareness is the so called “me” perceiving.

Suppose everybody and everything around carries this analysis. They will also reach the same understanding: they, themselves are Awareness.

It means there is nothing but Awareness all-around.



It is Awareness perceiving Awareness by being Aware. It is all One. Not Two. Advaita.

Awareness, being beyond birth and death, cannot have a birth. So **nothing could ever be born**. That's the **Truth**.

The "**Search**" we did thus far is meditation. To be steadfastly established in that Truth is Liberation.

We may ask, "Why does a world still appear to me?" Vedanta provides an answer through two basic models.

**Model One** : The world you see is as real as a dream. The wakeful world differs only in its space-time dynamics from dream world. (Brain records the same 40 Hz activity during dream or wakeful states!) Ego, mind, self, or whatever, is all part of dream and untrue. They are illusions. Like seeing a snake in a rope. You cannot cure an illusion like you cannot treat an illness experienced in a dream. You can only wake up or go into deep sleep. Just wake up and the dream automatically vanishes. Similarly, Truth prevails when Wakeful world vanishes (Swartz, 1996).

**Model Two** : The logic of triad (*triputi*) is used to explain the phantom world. If you see something, implicitly there are three things: observer (*drasta*), the observed (*dristi*) and the action of observing (*darsana*). That is to say that there is an observer distinct from the observed, the two being separated by a distance. The action of observing bridges the separation. A separating distance sprouts because the moment you look at a thing, the neuronal processing of identification of the object and positioning it vis-à-vis "me" takes place. In the absence of this mentation, there is only the action of observing. When only an action of observing exists, there are no "observer" and a separate "observed".

Could a Perceiver exist alone without a world to perceive? "Yes", says Vedanta. That "state of a seer without anything to see" is referred to as *Drik* (Potent-Looker) (Krishna Murthy, 2007).

[Many of the Buddhist Meditation methods and Cognitive Behavioral Therapies are based on this oneness of Observer-Observed-Observing.] To maintain that an observer is separate from the observed

(including positing Human vs. God, Disciple vs. Guru) is duality and not Truth.

Some more Questions and interestingly counterintuitive Answers:

### **1. If Awareness and Awareness only is there everywhere, why don't I see it?**

If you are an inseparable drop of water within the ocean and if there is nothing other than the ocean, can you view the ocean away from yourself? Therefore, you yourself are awareness! The world is not apart from you. The world is a seamless part of you.

### **2. What knowledge should I acquire?**

Nothing to be acquired. It's actually giving up what you have! Knowledge always grows. That means at any given time, the amount of knowledge learnt is limited. Hence it is forever incomplete and therefore, imperfect. What is imperfect cannot lead you to perfection. In fact knowledge becomes a burden. You have to empty yourself of all knowledge which is Ignorance (= nescience) in Vedanta! Drop all the known (remember: all the known is stored as memory which we call mind). So end the mind; not mend, bend, blend or grind it. Self ends when mind comes to an end. "That is a form of death while living", as Mr. J. Krishnamurti puts it (Skitt, 2003).

### **3. Who dies in the death of an organism?**

Nothing dies. What ends at the death of an organism is the imaginary "you"—your so-called personality which is nothing but a virtual entity put together staking a claim to an assortment of characteristics and memories as "yours". The organism also does not die, in a sense, because the materials (chemical elements) the organism is made up of get recycled and used again. Thus you could be having a few carbon atoms from the gut of Yudhistir! (The chemical elements that constitute our body are older than the earth and solar system.)

### **4. Do I renounce the World to be free from it?**

Well, you don't. Shri Nisargadatta Maharaj assures, "Do you give up the bed when you fall into deep sleep? You just forget it! Liberation is **not** being **free from** the world. It is being **free of** the world" (Dikshit, 1981; Powell, 2004). Free of "persona", only unnamed, unclaimed,

unchosen sensations remain. Body reverberates as One with every flutter of a leaf, ripple in water or cloud in the sky.

### CAN HUMANITY CHANGE?

This question is the tantalizing title of the book edited by David Skitt (2003) reporting Mr. J. Krishnamurti's dialogues with Buddhists led by Dr. Walpola Rahula and scientists like Prof. David Bohm. In his exposition, Mr. Krishnamurti did lead the group in a journey to the Truth through a deconstruction of many-taken-for-granted-pet-concepts. Still, an answer to the main question appeared nebulous. As if to highlight this, Part II of the book opens with an innocent but desperate question of a listener of Mr. J. Krishnamurti's talks. The questioner asked Mr. J. Krishnamurti why, in spite of hearing Krishnamurti for several years, no change had taken place in him (the listener).

Many religious leaders, politicians, ideologues and philosophers have been attempting for millennia of years to transform man into a happy individual and establish a harmonious society. Their philosophies could at best help a few individuals to keep the wayward mind under reins and to stay calm and composed in presence of happiness or adversity. But squalor and misery, conflicts and violence within an individual and in the society at large continue to the present.

Significant progress has been made of late in understanding neural codes (e.g. Nicolelis and Ribeiro, 2006) and how brain stores and retrieves information (Tsien, 2007). No single spot as "self" could be identified to exist in the brain. It was found that certain networks of neurons operate either singly or in overlapping combinations as 'gateways' for autobiographical memories. Those 'gateways' help provide a distinct identity as 'self' to an individual (Zimmer, 2005). Such an identity in turn furthers survival of the organism and protection of the body.

In contrast to the "self" (of an individual, *Jiva*), the "Universal Self" of a liberated person (*Jivanmukta*) identifies him as one with the whole universe. It is suggested here that human beings are possibly endowed with two distinct information processing nodes or "gateways": a private "self" and a "Universal Self." A person's apperception of the sensory information would depend on which gateway is used. Table 1 lists the differences in cognition from the viewpoints of "self" and "Self". A liberated man functioning with "Universal Self" as the center experiences ineffable bliss and inexplicable love-for-all. Ancient Indian scriptures hold

that such a state is the goal of evolution, the purpose of life and the objective to be reached by every human being.

However, a lurking doubt persists. After all, sorrow and suffering exist in the world. Disease and death are indefatigable. Misery cannot be wiped out or wished away. We know these as facts. In such a case, ability to regard the miasma of the visible world as unreal and viewing it as mere phantasm would be a clever coping mechanism. Is being lost in a noumenon only an escape from the phenomenal world? Even a *Jivanmukta* needs three morsels a day, has to pay taxes, requires an ID for travel, and will have to fix broken bones. With realization of Truth, he and the world do not evaporate into thin air like a dream dissolving on waking up!

However, there is a significant difference in living with a “self” or “Self”. This gets exemplified in “actions” as indicated at rows 11-13 in Table 1. Sage Vasishtha said that the actions of a *Jivanmukta* would not form impressions nor would they have a carry-forward effect (Krishna Murthy (2007a). It may be mentioned here that Mr. J. Krishnamurti (1989) in his talk of Nov 22, 1985 in India spoke about the possibility of ‘experiencing’ without forming a memory record in the brain. He said that the brain cells would then be free to mutate! Mutation in the neurons brings about an effortless change in the chemistry and structure of the brain.

As attested by several studies, neurochemical and biomedical enhancement of thinking and cognition can be obtained through a modification of the brain chemistry. A decade and half ago Mechoulam discovered a fatty acid produced in the brain that mimics marijuana. He named it “anandamide” after the Sanskrit word *ananda* meaning “bliss.” Anandamide is “a part of the brain’s endocannabinoid system that plays analgesic, anti-anxiety and antidepressant role.” A drug URB597 created by researchers in the USA and Italy is expected to be available in the market in 2008. The drug helps in inhibiting the enzymes that breakdown anandamide.

Oxytocin is a neurotransmitter long known to influence social behavior and cognition. Recent “research with rodents and non-human primates has shown that oxytocin, as well as the structurally similar peptide vasopressin, plays an important role in attachment and affiliative behaviors including pair-bond formation, maternal behavior, sexual behavior and separation distress” (Bartz and Hollander, 2007). Experiments demonstrated that oxytocin increases trust and social memory. “Liquid

Spray”, a product based on oxytocin, for enhancing trust is available commercially.

Future work on brain chemistry may be able throw up more such molecules that define the “ineffable bliss and inexplicable happiness” of a *Jivanmukta*.

Sage Vasishtha discussed several methods of nulling the mind in the 78<sup>th</sup> Canto, Chapter V, (The Calm Down) of Yogavasishtha (Krishna Murthy, 2008) leading to the state of a *Jivanmukta*. Of particular interest here is the following technique described for the arrest of mental processes:

“Open the mouth. Fold back the tongue and touch uvula with the tongue. Extend the tongue a bit more and press the uvula. Keep pressing uvula with the tongue and let air enter the Brahma *randhra*. Hold the air there. Then movement of life-principle will stop.”

Such techniques and more vigorous tantric methods prescribed elsewhere like further stretching the tongue to touch the pituitary suggest that a blissful state is achievable through manipulation of brain.

Let us hope that future scientific developments will be able to help in bringing about a shift from “self” to “Self” in the operational neuronal circuits of human brain. Every man will then function from a caring “Self” as center with a feeling that the whole universe is himself and not a private individual centered around a petty competing “self.” Or possibly a new discovery that may give a paradigm shift to our understanding, unimaginable in present day terms, is waiting round the corner!

**CONCLUSION:** The paper traces the mathematics-like precise logic of arriving at Oneness in sequential steps, principally based on the published conversations (teachings is a word not preferred by either of them) of Mr. J. Krishnamurti and Sri Nisargadatta Maharaj, well-known thinkers and philosophers who lived until the eighties. Some of the steps narrated here may seem wanting in detailed explanation. They have been kept cryptic, as otherwise the paper would run to several scores of pages. But it is hoped that the ‘fragrance’ of what is being hinted at by those stalwart philosophers can be felt. In order to scale up for mass application of what is achieved at an individual level to all of humanity, it is necessary to rewrite the high-skill algorithm to a low-skill routine. Understanding neurochemistry and the hierarchical neuronal “gateways”

responsible for operationalising a “Universal Self” as against an individual “self” may help in this direction.

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#### REFERENCES:

Bartz, J. A. and E. Hollander (2007), “Is Oxytocin the Key to Understanding?” entry in *Mind matters*, Sc. Amer., Aug 28, issue.

Dikshit, S. S. (1981), “I Am That - Dialogues of Sri Nisargadatta Maharaj”, Available on the internet, pp: 396.

Coulson, S. (2006), “Oldest Known Ritual: Python Worship”, *World Science*, Dec 6, 2006.

Krause, J. and others (2007), “The Derived FOXP2 Variant of Modern Humans Was Shared with Neandertals”, *Current Biology*, vol: 17, pp: 1908-1912.

Krishna Murthy, K.V. (2007), “Yogataaraavali of Adisankaracharya - Commentary”, English Translation by V. Ramesam, I-SERVE, Hyderabad, India, pp: 96.

Krishna Murthy, K.V. (2008), “Yogavaasishta”, Part IV, The Calm Down, English Translation: V. Ramesam, Avadhoota Datta Peetham, Mysore, India, pp: 194.

Krishnamurti, J. (1989), “The Last Talks”, Krishnamurti Foundation, India, pp: 100.

Kuhn, S. L. and M. C. Stiner (2006), “What’s a Mother to do? The division of labor among Neandertals and modern humans in Eurasia”, *Current Anthropology*, vol: 47, pp: 953-980.

Marean, C. W. and others (2007), “Early human use of marine resources and pigment in South Africa during the Middle Pleistocene”, *Nature*, vol: 449, pp: 905 – 908.

Nicolelis, M. A. L. and S. Ribeiro (2006), “Seeking Neural Code”, *Scientific American*, Nov issue,

Plotkin, H. (1997), "Evolution in Mind, an introduction to evolutionary psychology", Penguin, pp: 272.

Powell, R. (Ed) (2004), "The Ultimate Medicine - As Prescribed by Sri Nisargadatta Maharaj", MBP, Delhi, pp: 215.

Rilling, J. (2007), "Brain Imaging shows similarities & differences in thoughts between chimps and humans", Proc. Nat. Acad Sc, Online edition Oct 16,

Skitt, D. (Ed) (2003), "Can Humanity Change? - J. Krishnamurti in dialogue with Buddhists", Krishnamurti Foundation, pp: 224.

Swartz, J. (1996), "Mandukya Upanishad – An Ancient Sanskrit Text on the Nature of Reality, Available online, pp: 24

Tsien, J. Z. (2007), "The Memory Code", Scientific American, July issue, pp: 52-59.

Zimmer, C. (2005), "The Neurobiology of Self", Scientific American, Nov. issue, pp: 65-71.

Table 1: Comparative Attributes of an Individual (*Jiva*) and a Liberated Person (*Jivanmukta*).

INDIVIDUAL IS WITH A "self"	JIVANMUKTA IS "SELF"
WORLDVIEW:	
A sense of 'self' exists within.	Considers himself as All and All is himself - the 'One Self.'
Perceives a world 'out there' with one's own "self" at the center as the 'viewer'.	Perceives the world as himself and himself as the world.
Interested in self-preservation and self-protection.	Considers himself as eternal. Therefore, feels no need for self-preservation.
Thinks that he/she is the body and mind.	Considers himself to be beyond body-mind.
Experiences Pleasure and Pain; happiness and misery.	Pairs of Opposites like Pleasure and Pain etc. are experienced with equanimity.

Judgmental of things as good and bad, friend or foe with reference to “self”.	Lives things as they come. No acceptance or rejection.
Lives in 3-D world and experiences an irreversible Arrow of Time.	Lives in a world undefined by any bounds or dimensions.
Governed by cause – effect relationship.	Causeless. “It is abidance in the Self.”
Considers the wakeful state as Reality.	Considers wakeful, dream and deep sleep states to be same and equally unreal.
Strives for ‘continuity’ and perpetuation.	Has no strife for perpetuation as he exists forever.
<b>ACTIONS:</b>	
Actions are desire- and motive-driven.	Actions just happen on their own force.
Actions are done with a sense of “Doership” (‘I am the doer’).	No sense of “Doership” exists.
Actions done and experiences etch memories and are remembered.	Actions done and experiences do not get recorded as memories.
<b>KNOWLEDGE:</b>	
Knowledge gained as experience is preserved and passed on to next generation as cultural ‘Mememes’.	Acquired knowledge is incomplete and hence considered as ignorance. Being perfect within himself, does not need to acquire any knowledge.
Likes to transfer survival skills as heritable characteristics in the form of “Genes” to off-springs.	Has no need for transfer of heritable characters.
Goes through the cycles of birth and death.	Neither born nor does give birth to anything.



## 28. **NANRISHIH KURUTE KAVYAM** \*\*

(REMEMBERING DR. ALBERT EINSTEIN)

A.D 1898, 1899, 1900..... The years were rolling by on to the next century. Newton's Laws had stood good for nearly three centuries. They could accurately predict where a body would be found after a time if its current position and speed and directions of movement were given. Magnetism and electricity, heat and sound were reduced to equations that could be calculated for practical application. The equations were valid not only for any object on the earth but also applicable to the heavenly bodies – the nearby moon or the distant stars. Space with its three dimensions of length, width and breadth as well as time with its arrow were regarded as absolute since everyone experienced them the same way. The existence of atoms was still doubted; but everyone was certain that ether was all-pervading carrying light waves across space. Physicists were so smug with a feeling that everything to be known in Physics was already found out, but for, may be, a few loose ends. Physics was soon going to be a dead science, some even ventured to declare.

AD 1905. Month June. A young clerk in Patents office in Switzerland communicated a paper to the Journal *Annalen der Physik*. Max Planck who was himself a well-known physicist and the editor of the Journal realized that the accepted scientific order had been challenged by this unassuming paper. The author of that article was Albert Einstein. He demolished the absoluteness of space and time overthrowing Newton's theories. He spelt the end of ether too. The theory of Special Relativity was born. The world of Physics was shaken. In the same year Dr. Einstein proved the existence of atoms, laid the foundation for Quantum Physics, and established the particle nature of light.

In any of these, he did not go by the traditional wisdom. He broke new vistas of thought. He did not accept the '*smriti*' (knowledge banded down by communication). He listened to '*sruti*' (his inner voice). As the Sanskrit adage in the title of this article says, those who are not

Rishis can hardly break new thought. In this sense and also from the nature of his commitment to pacifism, freedom of thought and simplicity. Einstein can be described as a true Rishi unsurpassed to date in the world of Physics.

Einstein was born in 1879 in a small Jewish family in Germany. He passed away in 1955. Thus the year 2005 marks his 50<sup>th</sup> death anniversary and a century of Special Theory of Relativity. Even as a boy he was against falling in line with tradition and often liked to fly off freely in his thinking rather than conform to rigid controls. This attitude did not give him success in his school days, one of his professors calling him “lazy dog”. But the same professor later gave a mathematical interpretation of Einstein’s theory.

Einstein was not such an esoteric theoretician to be lost in the elegance of mathematical fantasy nor was he a laboratory man to be lost in the nuts and bolts of practical experiments missing the big picture. He was a thinking Physicist. He evolved his concepts through ‘thought experiments’. Sometimes he had difficulty in communicating the result of his vision and had to take the help of his friends for suitable mathematical expression. Einstein was unique in his prescience. “Seeing things no one else saw at the time.” As Prof Parker puts it, “It was almost as if he had a direct pipeline to what some call the mind of God”. Even to date several of the predictions based on his theories are being tested and proved in laboratories across the world!

Einstein showed that Time was just another dimension like length, height and breadth within the overall four dimensional space-time. Right ‘now’ you may be reading this article, there is the sun outside your window, your spouse humming a tune from across your room. You may feel all these are happening ‘now’. But, in fact, the sun appearing in your window is as it was eight minutes ago (the time taken by light to travel from the sun to the earth), you saw your spouse across the room as he/she was a fraction of a fraction of a second ago (time taken by light to travel from your spouse to your eye) and so on. None of these incidents have really taken place at the same time, though you say all of them are happening “now”. It is also true that a list of events happening “now” in your perspective may not be the set of events taking place in the “now” of another observer, their *nows* slice through space-time at different angles.

Depending on the observer’s position, different sets of events

may form the time lines within the four dimensional space-time. Einstein once said, "For we, convinced physicists, the distinction between past, present, and future is an illusion, however persistent". One may recall here the stories within stories within stories making a total mish-mash of the time sequence of events in the third chapter of Yogavaasishta. Perhaps Valmiki was hinting at the fallibility of the concepts of absolute time and space!

For an object moving at the speed of light, neither space nor time remains absolute. If people were to move at about 99.5 percent of light speed, their life expectancy would go up to 700 years. If an object is moving at about 98 percent the speed of light, then it would appear to a stationary observer as being 80 percent shorter than if it were at rest – that means that a 20 feet long car on ground will appear to be only four feet long when moving at the speed! The Special Theory of Relativity also says that *"the combined speed of any object's motion through space and its motion through time is always precisely equal to the speed of light."*

For a body (like photons), traveling at the speed of light through space will have no speed left for motion through time. Therefore, photons do not get old. They are always as fresh and young as they formed at the time of big bang (when the universe originated) because time stops at that speed. Photons are ever young and shiny, energetic and always on the move like Devas!

Einstein extended his Theory of Special Relativity to accelerated motion almost a decade later with further astounding consequences. The Theory of General Relativity was able to predict expanding universe, black holes, gravity waves, and helped define gravity which Newton could not do. As Prof Greene says, "Einstein's work showed that concepts, such as space and time, which had previously seemed to be separate and absolute, are actually interwoven and relative. Einstein went on to show that other physical properties of the world are unexpectedly interwoven as well. His most famous equation  $E = mc^2$  provides one of the most important examples. In it, Einstein asserted that the energy (E) of an object and its mass (m) are not independent concepts". Some of the scientists who were aware of the implication of this relation between mass and energy in the production of atomic weapons were concerned that Germany might develop the bomb and use it during the Second World War. In order to beat Germany in the game, they used the stature of Einstein to persuade

President Roosevelt to launch the highly secretive research on atom bomb. But that step made Einstein later regret the research into atomic weapons. He believed in a world government as the way for lasting peace, echoing what our sages visualized as "*Vasudaiva Kutumbakam*".

Einstein received the Nobel Prize in 1921 for his very first paper published in 1905 on his work on photoelectric effect establishing that light consisted of particles which itself was considered quite revolutionary. His other major contribution, namely, Quantum Theory was more of probabilistic nature than definitive like classical Physics. Yet, Quantum Theory proved to be highly accurate in describing the physics of small particles and a lot of younger Physicists like Heisenberg and Schrödinger were caught up with it and developed it further.

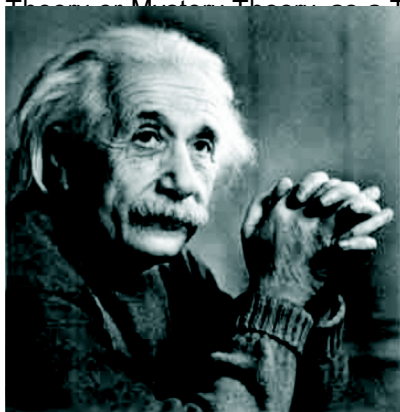
With constant questions and debates, he helped this branch of Physics to grow, though he himself remained uncomfortable and called it an incomplete theory. Still, he was the first to recommend Heisenberg and Schrödinger for the award of a Nobel. He received a paper from Satyendra Nath Bose of Calcutta in the early twenties. Though it had some mistakes, he corrected them, translated it into German and communicated it for publication. Later work based on these concepts helped Bose and Einstein to predict the occurrence of a new type of matter whose individual particles would lose all identity and the whole of it would behave as a single entity. It is known as Bose-Einstein condensate and its occurrence was proved only in the 1990s.

As Nazism was taking its root in Germany, he was amongst a handful of German scientists bold enough to sign a declaration for peace. When things became too uncomfortable for him, he moved to the United States in the early thirties. After the war, when he was requested to be the Head of State for the newly created Israel, he was magnanimous to decline and preferred to continue in physics. At that time his preoccupation was to bring in a unified theory of the four known forces in nature (gravitational, electromagnetic, strong nuclear and weak nuclear forces). He also tried to reconcile the Quantum Theory (dealing with the very small) with Relativity (dealing with the very big), convinced that "God cannot play dice" referring to the statistical nature of the former. During his last years, he was left out by his scientific colleagues of the mainstream physics as they felt that it was a wasteful effort. He even lamented once that he had become too old like a museum piece good only for occasional exhibition. The prevailing knowledge of Physics was far inadequate for such unified theory at that time, though he was inwardly convinced that it had to happen.

Einstein was well known for his one-liners and wit and this made him quite savvy with the media. His disheveled hair, loose fitting attire and absent minded looks contributed no less to his image of an archetypal professor. After he moved to the United States, he was still viewed with some reserve by the government in involving him in the war effort, though many of his colleagues were active in defense science.

When finally a naval officer approached him for joining the war related Research, he used to joke that he was in the Navy without having to cut his hair! Einstein was a musician (violinist), lover of nature and a romantic. When he was a student, he loved and married, against his family's wishes, a girl who was older than him, but separated later due to various reasons. After a few years, he married a widowed older cousin who took care of him when he was ill. She passed away shortly after they moved to the United States.

As Einstein said in 1932, "The real goal of my research has always been the simplification and unification of the system of theoretical physics." Several decades after his death, his vision appears to be fructifying in terms of M-theory, dubbed the Magic Theory or Mother Theory, ~~Theory of Everything (TOE)~~, unifying unifier, a yogi in science!



Special Theory of Relativity and the half-century  
since the passing away of Dr. A. Einstein)

## **Epilogue: Model to Test the Operational Mechanism of Non-Dualism**

*ABSTRACT: Ever since a capacity for abstract thinking dawned on man, he has been questioning the 'what and whys' of his existence and his relationship with the universe. His quest had urgency because of the inexorable natural forces he was exposed to and his own interest in conquering disease, decay and death. Each organism developed its own techniques of survival against the evolutionary pressures and the sum total of that knowledge is available to the human being stored in his brain. Invention of a fictitious 'self' helped him to distinguish himself as a distinct individual from the other and it helped in his self-propagation and procreation. However, it did not redeem him of the physical body problems nor could he conquer death. A few realized a way to dissolve the 'self' of body identity in an ineffable, indestructible, infinite and eternal nameless entity. Such people are known as 'Jivanmuktas' and the nameless Oneness they talked about is Non-dualism. The process of this transcendence from an individuating 'self' is Enlightenment or Nirvana.*

*Because enlightenment happens to an individual who still retains a body but with a changed 'worldview' of Universal Oneness, the change may have a correlate in his brain. Two distinct characteristics stand out as markers of Nirvana. One is the loss of a separating 'self' and another is 'non-doership' of actions. Modern neuroscientific techniques may help identify these markers either at a gross level of neuronal circuits or at a molecular level. The findings from the model study can be useful in mass scale application of non-dualism resulting in a harmonious society.*

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### **THE QUESTIONS:**

1. "Who am I? What is this universe? How did it come about?" are age-old questions asked by both philosophers and scientists.
2. Mankind has approached the questions broadly from two perspectives: (i) Redemption of sorrow and misery in the world. (ii) Curiosity to understand the 'why' and what of the processes. This tilt in approach may perhaps roughly distinguish, in a

historical sense, philosophical and religious systems on one hand and science on the other.

3. In addition to insecure life in the wild, natural hazards and conditions of 'uncertain futures', human beings had to struggle against disease, decay and death ever since man appeared on the surface of the earth.
4. Survival knowledge gained through experience is stored in the brain.
5. However, the accumulated knowledgebase in the brain goes back right to the time when 'life' originated on earth. There was a simple need to preserve the survival info in a 'replicator' for transmission to the offspring. Genes, memes (named by Prof. R. Dawkins for thoughts) and 'temes' (coined recently by Dr. S. Blackmore for technological ideas) served as replicators. Changes in the replicators brought about new species or organisms which proved to be more successful in survival strategies.

## THE KLUGE:

6. Brain is the storehouse-cum-processor with its own vast OS and I/O devices (neural codes of storage and retrieval mechanisms). Neurons in the brain are more than mere switches in a network. Each neuron is like a computer with its neural code of information flows.
7. Brain developed over billions of years like a 'kluge' with new layers of useful survival strategies added by successive successful phenotypes without revamping the total system (Linden, 2007, Marcus, 2008). It ever-remained an outdated and inadequate tool always lagging behind the faster moving evolutionary pressures of the environment (Zeman, 2008).
8. Since about 5000 – 10,000 years, changes in the brain seem to have occurred coinciding with the advent of agriculture and group-living (Evans and others, 2005, Voight and others, 2006, Biello, 2007) and also perhaps consequent coevolution of 'culture-memes', thanks to mirror neurons.

### A “self” WITHIN:

9. Concoction of a separate organismic ‘self’ within the human beings helped in providing an ‘id’ to each individual man in his survival struggle by bestowing embodiment, ownership, continuity and coherence to his distinct body. Thus the concept of ‘self’ contributed to ‘me’ vs. ‘you’ identification. But it unwittingly brought about in the process a fragmentation, a division of ‘me’ inside vs. the external environment or the ‘other’.
10. The ancient people starkly failed to conquer ‘disease, decay and death’. However, they could realize in a spark of brilliant analytical thinking that ‘sorrow and suffering’ was not a problem of the physical body. ‘Suffering’ was discovered to belong more to the invisible ‘self’. A few very intelligent people (Sages) found that they could transcend ‘sorrow’ if they identified their ‘self’ with an unchanging permanent entity instead of the constantly changing ephemeral body or the external environment. Thus a leap for the ‘self’ from the body to an ‘eternal entity’ appeared to an insuperable ‘win’.

### BRAHMAN:

11. That spacetime-emotion-invariant, limitless and ineffable ‘eternal entity’ was christened ‘Brahman’. It is concisely expressed in the cryptic ‘Four Great Vedic Statements’ (*Mahavakyas*). As a first approximation we may compare Brahman to a TV antenna – which remains invariant to the mood, color, language etc. of the program. So Brahman is like a sensing probe which senses everything but is unaffected by what is sensed. Such a sensor in the organism was discovered to be ‘Awareness’.

### NON-DUALISM AND NIRVANA:

12. Dissolving one’s separating identity (=‘self’) within that ‘Awareness’ without individuation is termed ‘enlightenment’ or ‘Nirvana’. (A working definition for enlightenment as given by primordial Non-Dualism: “When the assumed sense of being



separate seems to collapse, there is only the constant and unknowable Oneness of being"). It guaranteed freedom from suffering. This philosophy is Advaita or Non-Dualism.

13. An individual who achieves 'enlightenment' is called "Jivanmukta." The physical body of a Jivanmukta continues even after attaining enlightenment; so also its cancers or whatever. Enlightenment is a condition when one is unaware of a body, self or its sorrows/ comforts or even the world. This is exclusive to the individual. Enlightenment cannot be transmitted, inherited or conveyed. Achieving Nirvana will solve nothing of the bodily problems.
14. Where Advaita (the primordial *ajati vaada* of Shri Gaudapada) steals the march is in its explanation of the origin of the Universe. Creationists attribute the world to a loving God. Intelligent design is a clever alternate name for creationism. Scientists are able to explain in great detail the 'how' aspect of origin, from a point, say a singularity, 13.7 billion years ago. We have scientific surmises about what was there, if any, earlier than 13.7 billion years. The 'how' part is well known as 'Evolution' in scientific parlance. Advaitins come up with an amazing, unbelievable non-concept to explain the universe. They say universe is just an illusion! So also man and his problems. Consequently the questions we started with lose their locus. The oft-quoted metaphor is that the phantasmagoric universe is like non-existing water in a mirage or like a magician's trick of creating apples in air.

## NEUROSCIENCE:

15. Neuroscience also says that the world we see is an illusion – we see our own mental construct rather than what is real 'out here' (Macknik and Martinez-Conde, 2008). Neuroscience also says that there is no single spot as 'self' in the brain. A gateway node of 'self' that processes the information flow in certain neuronal networks could generate a feeling of 'self'. Losing some parts of the brain (most famous case is that of Phineas Gage) will change the person / personality (i.e. the lumped parameters that define the identification of an individual i.e. 'self').
16. When an individual 'realizes' enlightenment, the "self" node in the brain maybe overtaken by a "Universal Self" node, another

gateway node in the brain for processing the information sensed from the environment . The worldview from the 'Universal Self' node may correspond to what is described as Paramarthika (Absolute) viewpoint of a Non-Dualist. Taylor (2008) gives a graphic description of her Nirvana and says she lost the sense of separating "I" when her left brain was damaged. She holds that the right brain connects one to infinite consciousness. Many other neuroscientists place the knowledge of "I" in the right brain (e.g. T. E. Feinberg, J. Decety, J. A. Sommerville, J.P. Keenan, L. Uddin quoted by Bower, 2006). One has to be first sure where the "I" network operates from before we can locate the 'Universal Node.'

17. Therefore, a shift in the functioning of the gateway node from that of 'self' node to "Universal Self" node could be Nirvana. The ancient Indian text Ashtavakra Gita (I – 11) says that liberation and bondage are nothing but the way the mind works. Same opinion is expressed by Maitri Upanishad (VI - 34-11).

#### **A COPING MECHANISM?:**

18. Is "Non-Dualism" then a eulogized and glorified "coping mechanism", a "survival tactic" discovered by a few in the past because, anyway, they failed to conquer death or solve the physical body problems and the best way to cope is to lose the organism's self-protecting and self-perpetuating concept of 'self'?
19. As long as 'self' continues in a body that is alive, brain cannot be dead. So the brain continues to tick and produce waves in an EEG. Thanks to fMRI, PET, SPECT, DTI (Diffusion Tensor Imaging) etc., one can probe which set of neurons are acting under which state. Technology has now developed even to record single neuron activity (e.g. 'Halle Berry' neuron). Brain is regarded to be highly plastic (hence moldable by training) at any age (new neurons and better synaptic connections do generate at all ages).
20. So it is possible that if some individual shifts from "self" to 'Universal Self' (on Enlightenment), some correlate maybe available in the brain. Dr. J. Austin said as much a decade ago.

21. As an example to support the contention under 20 above, I would like to cite dreams. Dreams are highly subjective, individualistic. They belong to a non-existent world that vanishes on waking up. (Vedantins equate dream world to the wakeful state every day world). Still there is an identifiable correlate of the dream that we can record in our world.
22. Even today we have a large number of so-called “Realized” persons who say they found the ‘Oneness (Non-Dualism).’ They do not have a ‘self’ as we normally have. The world perceived by us all (from our ‘self’ node) is unreal for them. What exists for them is an unfragmented “Oneness”, unborn and unending. Many sites provide web links on the Internet to Non-Dualism teachers e.g. [advaita.org.uk](http://advaita.org.uk). A nodal place for their books is Non-Duality Press, Salisbury, U.K. All such ‘realized’ teachers, however, apparently still continue to experience the world; they do feel hungry and need to eat and maintain relationship with spouses and family.

[We should mention here another glaring point with regard to Nirvana. It is not so much of Freedom as it is claimed to be. Freedom is a misnomer. How can one be free, **independent** in the face of **dependence** on food, oxygen etc.? Food involves predator – prey conflict, violence and absence of love for prey (for killing and eating) and consequent guaranteed misery for the prey. It conspicuously points to the reality of distinction between ‘one’ and the ‘other’, negating the ‘attributes’ we ascribe to Brahman:

**i) Individuation:** My consumption of food does not satiate the stomach of the ‘Enlightened one.’ Thus ‘I’ am separate from ‘him’. So there are ‘two’, not one.

**ii) Friend – Foe distinction:** Life depends on life to be alive and perpetuate! The predator hunts the prey with violence and not love. The prey is mortally scared of predator. Predator is ‘one’. Prey is the ‘other’. Where is the infinite love of oneness for all?

**iii) Bounded Spaces:** The prey runs for its security and searches for ‘safe spots’ to hide. So space is partitioned

discretely with boundaries of safe zones or traps of death. It is not unbound limitless one space without parts!]

### **NEURONAL CORRELATES FOR NIRVANA:**

23. Two prominent features stand out in the functioning of a liberated individual, functioning from a “Universal Self” node and an ordinary person operating from ‘self’ gateway node. These are: ‘Doership’ and ‘thought processes’. The liberated individual does not act with notions of ‘doership’ like “I do, I act, I eat etc.” So also his responses to questions are said to be automatic and no thinking precedes the response. These two features can be the ‘markers’ observable in their brain scan.
24. It will be highly educative to see if the Non-Dualists (who achieved Oneness) operate and function in the world using a gateway node of neural network hierarchy distinctly different from the ‘self’ node of neuronal networks used by normal (‘unenlightened’) folk. A detailed examination of their brain scans using a suitable technique should show the difference, if any. If the neuronal circuits do not show the difference, we may have to investigate at a molecular level – say, the number of proteins driving the synapses (which affect finally perception and cognition) – following the work of Emes et al, 2008.

### **PROGNOSIS:**

25. The next step would be to find the physicochemical and electrical processes that can shift the brain operation from ‘self’ node to ‘Universal Self’ node so that we have a harmonious conflict-free society of ‘enlightened’ individuals.

Can Science lead us to a better appreciation of Life and take us towards achieving ‘A Happy Individual and a Harmonious Society?

### **REFERENCES :**

- Austin, J. H. (1999), “Zen and the Brain: Toward an Understanding of Meditation and Consciousness”, MIT Press, pp: 872.
- Biello, D., (2007), “Culture Speeds Up Human Evolution”, Scientific American, December, 10.



Bower, B. (2006), "Self-Serve Brains: personal identity veers to the right hemisphere", Science News, February.

Emes, R.D. and others, (2008), "Evolutionary expansion and anatomical specialization of synapse proteome complexity", Nature Neuroscience online.

Evans, P. D. and others, (2005), "Microcephalin, a Gene Regulating Brain Size, Continues to Evolve Adaptively in Humans", Science, Vol. 309, pp: 1717 – 1720.

Linden, D.J., (2007), "The Accidental Mind", The Bellknap Press, pp: 276.

Macknik, S.L. and S. Martinez-Conde, (2008), "A Perspective on 3-D Illusions", Scientific American Mind online, October.

Marcus, G., (2008), "Kluge", Houghton Mifflin Company, pp: 211.

Taylor, J.B. (2008), Lecture at TED.com in February, available online.

Voight, B.F. and others, (2006), "A map of recent positive selection in the human genome", PloS Biol. Epub 2006 Mar 7.

Zeman, A., (2008), "A Portrait of the Brain", Yale University Press, pp: 246.

***List: Scientists whose work was referred to in the  
preparation of the Articles:***  
(The list is not exhaustive)

Austin, J. H.	Haisch, B.	Radin, D.
Beauregard, M.	Haldane, J. B. S.	Rahula, W.
Beecher, H. K.	Hameroff, S.	Raichle, M.
Benson, H.	Han-Seok Seo	Ramachandran, V. S.
Blackburn, E.	He, B.	Ramsey, N.
Blackmore, S.	Heatherton, T.F.	Rehman, J.
Blakemore, S.-J.	Hensch, T.K.	Reiss, A. (Physicist.)
Bohm, D.	Herlitz, A.	Reiss, A.
Bohr, N.	Higgins, C.M.	(Psychiatrist).
Boroditsky, L.	Higgo, J.	Reiman, D.
Brodie, R.	Ho, K.	Revonsuo, A.
Bower, B.	Holstege, G.	Ricard, M.
Buszewski, B.	Hoyle, F.	Richards, L.
Butler, C.	Janssens, R.	Scaruffi, P.
Cahill, L.	Kandel, E.R.	Schrödinger, E.
Cairns, J.	Koch, C.	Schwartz, A.
Callahan, C.M.	Kornhuber, H.H.	(Pittsburgh).
Casimir, H.B.G.	Krauss, L.	Schwartz, J.
Chalmers, D.	Krystall, J.H.	Searle, J.
Chopra, D.	Lazar, S.	Siegel, J.
Crick, F.	Lee, M.	Sinclair, D.
Cruikshank, D.	Leggett, A.J.	Singer, T.
Cziko, C.	Leonard, W. R.	Smythies, J.
Davidson, R.	Levin, J. S.	Steptoe, A.
Davis, T.	Libet, B.	Sollerman, J.
Dawkins, R.	Lieberman, R.P.	Stevens, A.
De Duve, C.	Li-Huei Tsai	Sudarshan, G.
DeRubeis, R.	Lipton, B. H.	Sulzer, D.
Dobson, J.	Lorenz, R.	Sur, M.
Edwards, K.	Lowry, C.	Swain, M.
Einstein, A.	Lutz, A.	Taylor, J.B.
Elias, P.	Macknik, S.L.	Tegmark, M.
Evans, D.	Marcy, G.	Tilburt, J.
Feinberg, A.P.	Marguils, L.	Tinetti, G.
Feynman, R.	Martinez-Conde, S.	Tononi, G.
Franks, N.P.	McCrone, J.	Tsia, Li-Huei.
Freud, S.	McDermott,	Wager, T.D.
Gabbard, G.O.	Mechoulam, R.	Walker, M.
Gallese, V.	Musser, G.	Wedekind, C.
Gardenfors, P.	Nathanielsz, P.	Wheeler, J.A.
Gaudi, S.	Newberg, A.	Winson, J.
Gaudente, L.	Nisbett, R.	Yuki, M.
Glausiasz, J.	Ornish, D.	Zeidler, A.
Goldberg, I.	Penrose, R.	Ziurys, L.
Gordon, J.I.	Persinger, M.P.	Zubieta, J-K.
Gradinarov, P.	Polzik, E.	
Grant, G.	Quiroga, Q.	
Greene, B.		
Groth, S.I.		



**I-S.E.R.V.E**

**INSTITUTE OF SCIENTIFIC RESEARCH ON VEDAS**

### **Background:**

Nobel Laureate Dr. E. Schrodinger said that he was inspired in his path breaking work by a study of Upanishads. Sir Jagdish Chandra Bose attributed his thesis on plants as living things to a study of Vedas. These examples show that the ancient Indian civilization was quite advanced and well developed in scientific applications. In today's world it has become mandatory to seek more nature-friendly and eco-friendly scientific knowledge for sustained development. Such skills and wisdom were abundantly available during Vedic and Post Vedic times. Therefore, a search into our past glorious knowledgebase will be highly rewarding and germane to the current societal needs. But understanding the ancient scriptures is not easy, as the present Sanskrit scholars are not familiar with the technical terminology used in those times. Preparation of lexicons of antique scientific terms would surely help us in understanding the ancient scientific literature.

### **Genesis:**

With this end in mind, I-SERVE (The Institute of Scientific Research on Vedas), a Charitable Trust with its head quarters at Hyderabad was created on the advise and divine command of **His Holiness Parama Pujya Sri Sri Sri Ganapathi Sachchidananda Swamiji** under the Chairmanship of **Sri Kuppa Venkata Krishna Murthy**, the Vidyadhikari of Avadhoota Datta Peetham, Mysore. I-SERVE is directed by a Guiding Committee, Advisory Committee and Honorary Professor Committees comprising eminent men who have distinguished themselves in various fields relevant the interests of I-SERVE.

### **Direction:**

Some of the tasks that have to be taken up immediately are:  
Bibliographic cataloguing of all the available ancient scriptures in different languages;  
Preparation of abstract in English or Telugu based on those texts;

Analysis of their meaning in modern scientific terms;  
Preparing standard thesauri and lexicons of the technical words used in the Scriptures;

**Benefits:**

Demonstrable benefits that could accrue from such efforts are:

1. New theories and branches of sciences may emerge when once the above steps are fully implemented.
2. With the emergence of this nonhazardous and pollution free techniques, there is scope for developing appropriate industrial and manufacturing technologies for efficient and eco-friendly utilization of the natural resources.

**R&D Projects undertaken:**

*I-SERVE has undertaken with the above aim a number of research projects ranging from application of Panini's Sanskrit grammar in the development of new computer language to a study of earthquakes and rainfall prediction. Some of the other ongoing Projects are:*

**Book search project**

To create a Data Bank of the source books and to publish catalogues of ancient scientific manuscripts /out of print old books in India – state wise. As on date, the catalogue for Andhra Pradesh is ready for printing.

**Ancient mathematics:**

Apart from the set of 16 formulae proposed by Sri Bharati Krishna Tirtha Swamiji' we plan to study mathematics form (1) Sulba Sutras (800 BC) dealing with geometrical aspects of Fire pits and Yagna Salas etc., (2) References of astronomical calculations in Rigveda (3) Geometry of Tantra sastra in the context of constructing yantras etc. and (4) 3-D spherical geometry of Jyotisha Sastra.

**Ayurveda:**

To study Ayurveda both from the traditional as well as modern angles;  
To Translate into Telugu and English the medical section of Ravana Samhita, an age old treatise;  
Translation of concerned chapters related to Visha Vaidya from Bhavishya Purana.



**Data Base:**

Building data base for creating evidence on Ayurvedic medicines is a major work taken up by I-SERVE.

An Ayurvedic Research Centre was established in February 2006 a **free ayurvedic dispensary** is being run since then.

Studies on Medo Vriddhi (Obesity) and Sandhivaata ( Arthritis) and research on Khashayas and Anupanas for their microbial information are being carried out.

**Earth science & Environment**

To study the nature friendly procedures of exploration of mineral wealth;

To study ancient mining techniques;

To study ancient pollution control methods for environmental purification

**Study of Atharvana Veda and Puranas**

1. Comparison with available classical texts of Vedic Sciences.
2. Comparison with available classical texts of Modern Sciences.

**Seminars & workshops:**

I-SERVE held several seminars and workshops on diverse topics of interest since its inception and brought out many publications. A quick list follows:

2005 : National Conference on “Vedic Knowledge: Contemporary Relevance”

2006 : National Conference on “Ayurvedic Medicare as Evidence Based Medicine” ;

2006 : National Seminar on “Vedic Astronomy & Cosmology”

2007 : Introductory Classes on “Panchanga Siddhanta” (Almanac related Astronomy)

2007 : International conference on “Indian Sciences in the Pre-Adi Sankara Period”

2008 : National Conference on “ Ayurveda(CME) Programme

2008 : Workshop on “Vedic Mathematics”

**Publications:**

1. 2005 National Conference Vedic Knowledge) Volume
2. 2006 National Conference (Ayurveda) Volume I & II
3. 2006 National Seminar (Astronomy) Volume
4. 2007 Introductory classes on panchanga Siddhanta Volume
5. 2007 International Conference - Indian Sciences in the Pre-Adi Sankara Period
6. 2008 : National Conference on " Ayurveda(CME) Programme volume
7. Pre Siddhantic India Astronomy - by Prof. K.D. Abhyanakar
8. Spectrum of Vedic Sciences.
9. Sanatana Desamlo Adhunanatana Vijnanam
10. Modern Science in the Ancient Land
11. Sambhormurti (Telugu)
12. Yogataaravali (Telugu)
13. Yogataaravali (English)
14. Ganesa Sarvaangeena Stuti (Telugu)
15. Hymn to Ganesha
16. Chituku Chikitsalu
17. Intinti Vaidyam (Dattamrutam)
18. Glimpses of Vedic Mathematics